

The background features a series of overlapping hexagonal shapes. The top hexagon is light yellow with a pattern of thin, dark diagonal lines. Below it, a darker hexagon with a similar pattern is partially visible. To the left, a dark grey hexagon with a pattern of horizontal, wavy lines is partially visible. The text is centered within the light yellow hexagon.

Project [viaStation]: *Empowering New User Access to Bike-Shares in Smaller Markets*

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ID@GT :: Spring 2013

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EXECUTIVE SUMMARY

In November of 2011, Georgia Tech welcomed its first automated bike-sharing service. Since then the founders at viaCycle have continued to expand and improve their platform. However, after opting against on-site kiosks due to their low cost, low infrastructure approach, it has been difficult to accelerate new-user adoption and readily assess its scalable impacts. This project intends to eliminate that particular barrier by proposing an alternative kiosk system that utilizes a minimal amount of infrastructure while potentially transforming the platform's accessibility and service design. The success of such an intervention could help pave the way for a new era in bike sharing where the ability to implement modern systems in smaller, yet needy markets is a viable reality. The major collaborators in the project were viaCycle, Georgia Tech's Parking & Transportation office, and campus transit awareness groups.

The primary research included readings on the state of art, case studies, several stakeholder interviews and participatory evaluations. Currently it is well understood that, for the context of Georgia Tech, the solution needs to be relatively cost effective in terms of parts and implementation. That said, it remains to be seen what transportation niche viaCycle and the university would like the service to fill in particular; this has many implications for the incorporation of possible 'viaStations'. Second, it is important to better understand how to impact the perception of bike sharing, whether having a centralized access channel/structure versus a dispersion of 'channels'. To approach these there is a need to identify the most prominent themes and heuristics, which will also go far in leading successful concept implementations.

/BĪK-SHÂR/

The definition of public bike-sharing is understood as follows:

“The first definition describes bicycles that are intended for short-term use by the public and that are available for check-out at unattended urban locations. The second and broader definition of bike-share is public transportation via bicycle. These two definitions are not mutually exclusive and are best thought of in combination.”

— Ed McCormack et al. (2010). Seattle Bicycle Share Feasibility Study Report

1. BACKGROUND



1.1 Introduction

Today's bikesharing systems are increasingly streamlined for automated, on-demand service. Contemporary setups have the user locate an in-service station and subsequently sign into its network connected system using a PIN or smart card. Then, after checking out any available bike at the site (often co-located near the regular bike racks), they would ride to the station nearest their destination. At this point the bike is checked out by docking it securely and ending the trip.

Using a unique technological platform that originates from the labs of Georgia Tech,

there is an opportunity to help broaden the implementation of bike-sharing across the U.S. -- not just in major metropolitan cities -- where car-use and single-person vehicle occupancies are generally high. Due to the steep costs of implementing many contemporary systems, most of the commercial focus is on dense metropolitan cities with high revenue potential. This contributes to bike-sharing's position as a relatively new, under-utilized transit option in the U.S. To change this, there is a need to lower barriers to entry for being able to offer bike share services.



Source: How it Works, B-cycle.com

In the past 18 months viaCycle, a new bike share startup consisting of former and current Georgia Tech students, has established a service platform that prides itself on a low-infrastructure, “bike share in a box” approach. Their value proposition is to offer an easy and flexible travel option that enhances campus life.

The following are key aspects of the system:

- the Georgia Tech operations consist of almost 40 active bikes and 8 ‘stations’
- service subscriptions are exclusive to students & staff
- use requires pre-registration online
- available 24/7 in rideable conditions
- integrated electronic lock allows one to temporarily secure bikes to any rack/or fixture between stops while checked out
- each unit contains GPS transmitters for constant tab-keeping of bike location
- user currently uses a mobile phone to unlock a given bike by sending an SMS consisting of the number of the desired bike in combination with their unique numeric PIN code.
- bikes automatically checked out on return to designated service locations
- the bikes are geared with

height-adjustsable seats and handle-bars

viaCycle’s bikes (Figures 1-3) have a distinctive, swooping frame as well as leather seats and handles. Fixed on the rear axle is their proprietary lock with LED lights that indicate



Figure 1: viaCycle@GT's Launch Day , Nov 2011



Figure 2: Sideview of a current-generation viaCycle@GT bike



Figure 3: Close-up of the proprietary electronic lock

whether the bike is available (green), reserved (yellow), in use (red) or offline for maintenance. While the units are currently powered by nickel-metal hydride batteries that require periodical charging off-site, viaCycle is preparing a limited rollout of a solar-powered version.

The Georgia Tech operation was the company’s first and began as a pilot program that propelled the concept into its current public-private operation model, where the school subsidizes viaCycle operations for being able to host the service. It has since become a notable selling point for the school and an influential partner to transit awareness groups on campus.

Today, viaCycle’s operations have extended to George Mason University near Washington, D.C. (20 bikes) and, more recently, as far as a district in downtown Las Vegas as another pilot program. Farther still, there are talks of bringing the bikes to Google’s main campus in Mountain View as well. Should these expansions be viable, viaCycle could hit their target of growing to a nationwide fleet of 500 bikes by the year’s end.

1.2 The Premise for Bike-Sharing

The research has imparted an understanding of bike sharing's core premise for aiding the sustainability of communities by offering a more efficient mode of transportation. This project's larger contribution outside of Georgia Tech would be to the progression of this particular transit mode, which for any region has the intended effects of:

- 1. Improving public health by increasing the cycling population, in terms of the rate of both public and private bike use**
- 2. Reinforcing the use and functionality of existing local transit systems**

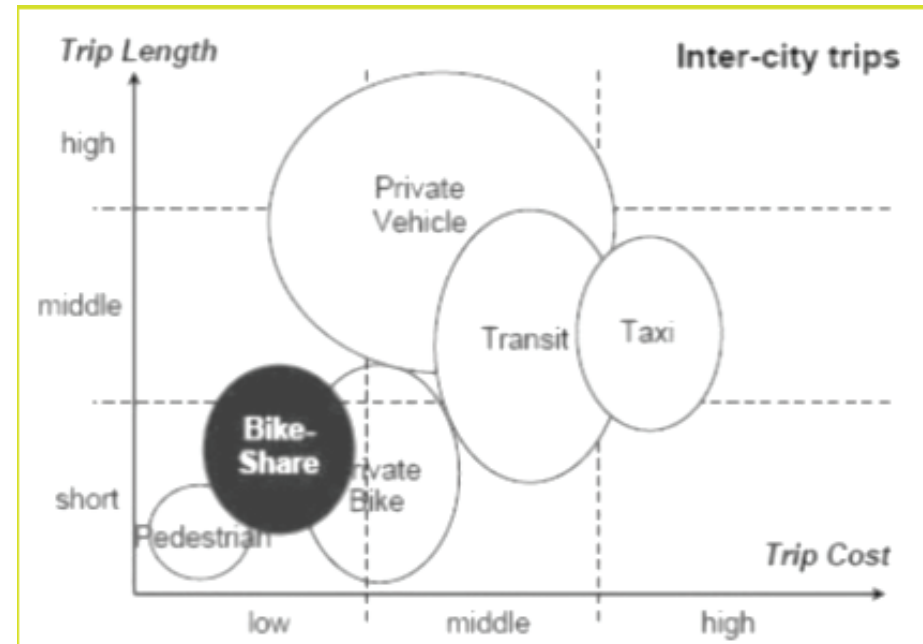


Figure 4: Bikeshare's functional space as compared to other common services

Source: Quay Communications Inc. 2008

1.3 Challenges at GT

- Service is difficult to identify
- Use requires pre-registration
- No on-site display of real-time information (e.g. bike availability)

The image in Figure 4, taken at the major bike rack in the vicinity of the campus' Instructional Center building, depicts a challenge that really is at the heart of what this project seeks to address: the indecipherable nature of the service. While a notable contributor to this is viaCycle's sharing of bike racks with private bikes at practically all of their stations, there simply are no obvious visual queues to highlight the presence of service bikes at the assigned stations. Indeed the only signage is a single static paper insert that is set atop the rack by a steel bracket fixture.

A more tangible barrier to access is the requirement due to security concerns, that one registers for the service or pays online prior being able to check out a bike. The process allows viaCycle to verify your staff or student status, as well as receive payment and confirmation of your identity.

The previous chart is one way to depict the functional space that bike sharing occupies in the field of urban transit options. In terms of the "Transit" that would encompass bus, metro and tram services, there clearly are limits to the capacity and operating range that would be well addressed by the availability of shared bikes. This is especially true during peak daytime hours and after regular operating hours.

As a compliment to these more ubiquitous public transit systems it has thus made sense to build the bike infrastructure alongside other transit structures, particularly in a cities where parking spaces are highly limited. This visible convenience has the effect of encouraging daily transit riders to forego probable dependencies on vehicular ridership and take up the healthier cycling option.

In the case of Georgia Tech and its relatively high concentration of campus commuters, reducing the load on parking and improving the school's 'green' profile were key to viaCycle's successful implementation.



Figure 5: Signage (left) and designated viaCycle station that's shared with private bikes

On top of that challenge is the fact that there's no presentation of real-time information without the user having a smartphone handy to pull up the service website. This makes it such that the user must now juggle two distinct points of interaction and, thereby, two distinct contexts for informing their service use. The absence of a kiosk-like interface exacerbates all of the noted challenges, especially as experienced by novice users -- and as it turns out, Georgia Tech has many.

While usage is growing steadily, there is insufficient awareness and a limited profile of the service among students for it to reach its full impact potential. Meanwhile, there is a desire by the company to grow into a more comprehensive, 'consumer-facing' operation where they lease out the platform to the many smaller markets that would like to add a bike share option to their transit offerings. It is out of these directives that this project was initiated to explore the potential utility of physical access channels that would effectively support the company's service design at Georgia Tech and possibly beyond.

where's viaCycle?

2. PROJECT SCOPE



Source (of graphic): Mineta Transportation Institute, San Jose, CA

/SKŌP/

Noun:

The extent of the area or subject matter that something deals with or to which it is relevant.

2.1 Opportunity Statement

ViaCycle's approach to flexible bike-share has the potential to open up the service to a diversity of smaller markets where a fixed price in the tens of thousands of dollars -- per station -- for current (3rd-generation) platforms is usually very prohibitive...

This project sets out to deliver a novel alternative to conventional bike-share kiosks that supports an enhanced user experience and service design. Together, these would help the viaCycle platform be more accessible to bike-share novices. Also, it will do this while advancing the existing 'flex-fit' approach alongside new and emerging innovations.

...Having the potential to improve quality of life in the built environment, this intervention would also contribute to a new transit ecosystem where users may appreciate the practical utility of bike travel more readily.

2.2 Key Stakeholders

Kyle Azevedo, CEO of viaCycle

Kyle shepherds a multitude of aspects surrounding viaCycle operations and, as such, is tuned-in to all activities from the ground level on up. He got his Master's in Mechanical Engineering from Georgia Tech with a research focus in urban transportation.



Photo© Natalie Brasington

Sid Doshi, CTO of viaCycle (left)

In his role as Chief Technical Officer, Sid steers much of the engineering design as well as web/app development. He's also a graduate of the MS ME program at Georgia Tech and had a focus on Systems Design.

Yuriy Romaniw, viaCycle Engineer (right)

Handling the major part of their hardware and manufacturing design, Yuriy is currently a PhD candidate in ME at Georgia Tech.



Source: CNNMoney

Johann Weber, Student & Bike Advocate

A graduate student of Public Policy at Georgia Tech, Johann's made quite the splash around town with cycling advocacy at various levels of planning and policy engagement. He's the sitting chair of GT's Bicycle Infrastructure Improvement Committee

**Aaron Fowler, (former) Campus Transportation Planner at Georgia Tech**

At the time of this study, Aaron was planning and managing alternative transportation programs on campus, including car-sharing, ride-matching, bike-sharing, electric vehicle charging, bus transit planning and bicycle infrastructure. He oversaw the initial service implementation of viaCycle@GT.

Amy Ingles, Student and Transit Advocate

Amy founded and is the current president of Students for Progressive Transit at Georgia Tech, which seeks to engage the student community in the region's transportation issues. She is pursuing her Masters in City and Regional planning.

**Oleh Romaniw, (former) viaCycle Operations Manager**

Yuriy's brother was tasked with key aspects of bikeshare: bike redistribution and technical maintenance. He possesses a keen understanding of the system's operation. He's also a graduate student at the Catholic University of America.



2.3 State of the Art

This review was instrumental to gaining an overview of the innovation potentials in the area of flexible bike share designs, from both hardware and service perspectives. Each of the following systems was selected to represent a unique take on flexible bike share, all with unique mixes of technology.

GBike, Mountain View (CA)

Service type: free campus amenity

Target: Google employees & visitors

Operation model: private operation that distributes the bikes for free use

Key Features: 20-in wheels, basket and bell



Zagster, Boston (MA)

Service type: bike-share vendor

Target: businesses, colleges and properties

Operation model: private-private operation leasing out the platform + customer support

Key Features:

- lock box: use your cell phone to text a service number with a bike request and receive the code to unlock the bike's box; enter this on the number pad to access the key to an attached U-lock
- return the bike anywhere after use
- book a specific bike online for a day
- conventional bike frame



CitiBike/Alta, New York City (NY)

Service type: bike-share operator, vendor

Target: highly populated urban markets

Operation model: public-private operation between NYC and Alta; CitiBank sponsorship

Key Features:

- solar-powered kiosks with docks that have integrated bike locks
- touchscreen displays service map, information, and allows user to release bikes using a card or access key
- distinctive bikes with protective bag rack
- CitiBike App helps you plan your route

Of these flexible bike-share systems, only CitiBike utilizes a 'fixed-portable' kiosk -- though the portability of the kiosks is open to debate seeing as they require the use of a compact crane to move, which adds up to an overall cost in the neighborhood \$2000 every time it occurs. It's also



SoBi, New York City (NY)

Service type: bike-share vendor

Target: all markets

Operation model: public-private and private-private operations; still in beta/pilot phases

Key Features:

- solar-powered integrated electronic lock and keypad: allows one to unlock bike using PIN code
- book a bike online or the via mobile app
- return the bike at designated 'hub' areas to end reservation via GPS tracking
- Conventional bike frame with basket

quite apparent that the viaCycle platform bares the most technical resemblance to SoBi's; from the integrated electronic lock setup to the GPS and bike check-out mechanic. What seems to differentiate it from these systems though is its characteristic of adhering more to traditional bike-shares in terms of its look, branding and current operation model, but while leveraging flexible and 'smart' bike approaches. So we know there's a diversity of approaches to flexible bikesharing, but which one's are truly successful in providing the intended transportation service? The following radar chart compares the platforms on more conventional success factors:

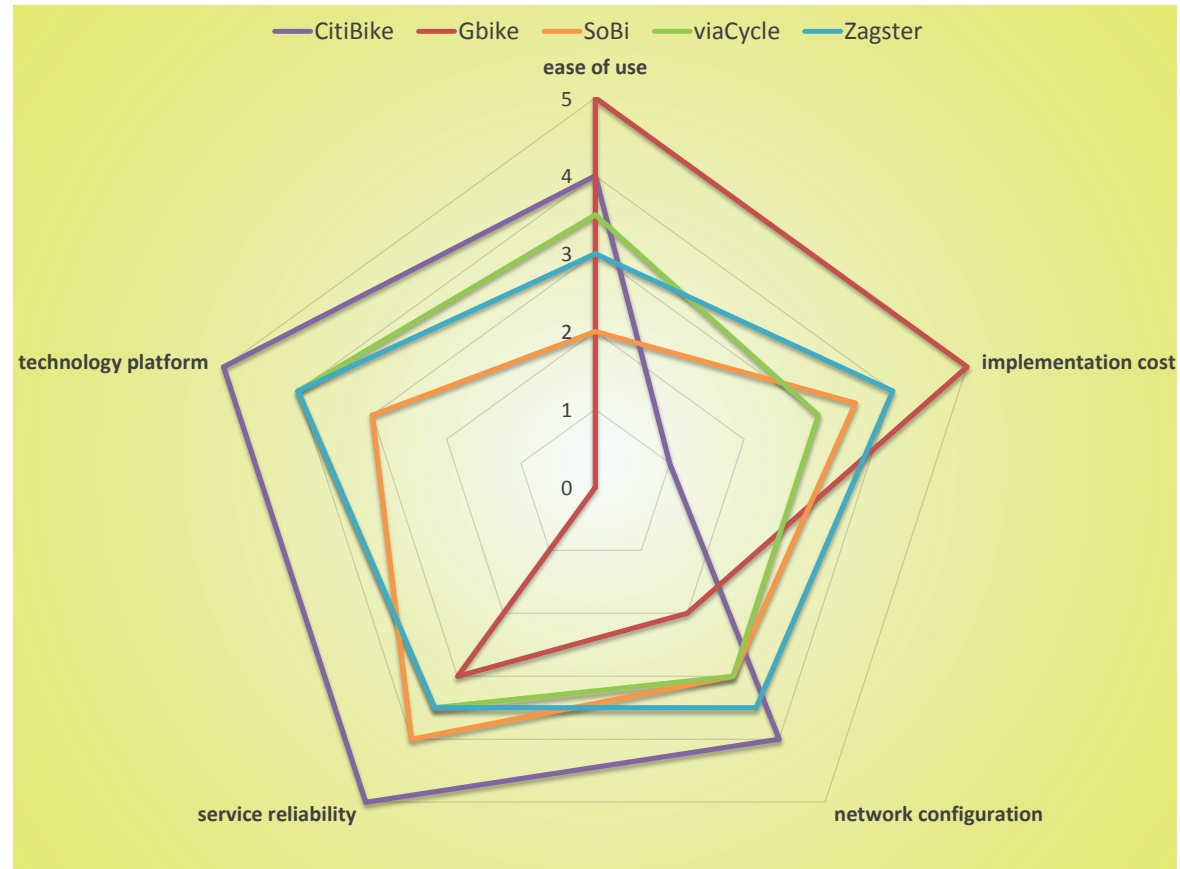


Figure 6: Comparing contemporary flexible bike-share platforms

The success factors noted in Figure 6 would point to the viability of each of the contemporary platforms as fully-fledged bikesharing systems of at least 20 bikes. Point totals for each quality, all of which were noted in a TransLink feasibility study from Vancouver, Canada in 2008, were tallied up based on whether 5 sub-qualities were represented by the respective bike-share service platform or not (see APPENDIX). Relatively speaking, it bears out that CitiBike (19 quality points) would be most costly yet the most viable overall, while GBike (15 pts) and SoBi (15.5 pts) would need to address the most shortcomings to better deliver their full potential.

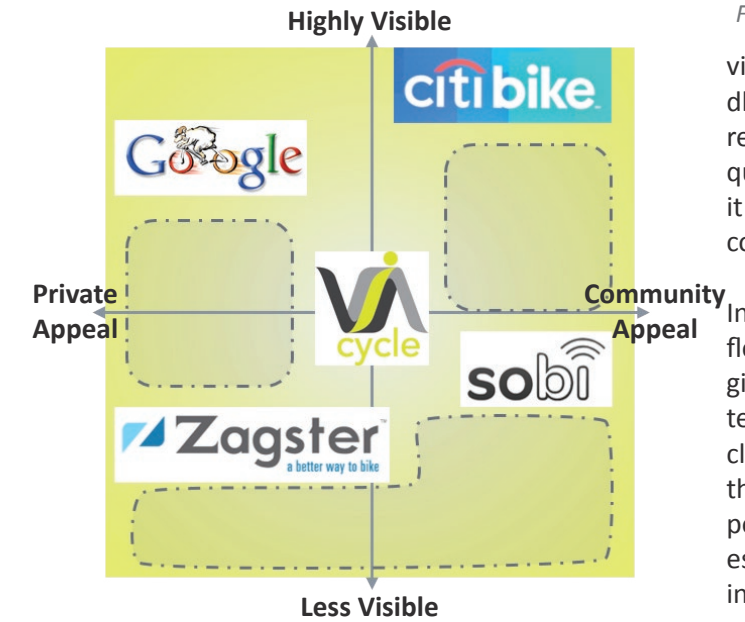


Figure 7: Appeal versus visibility of platforms

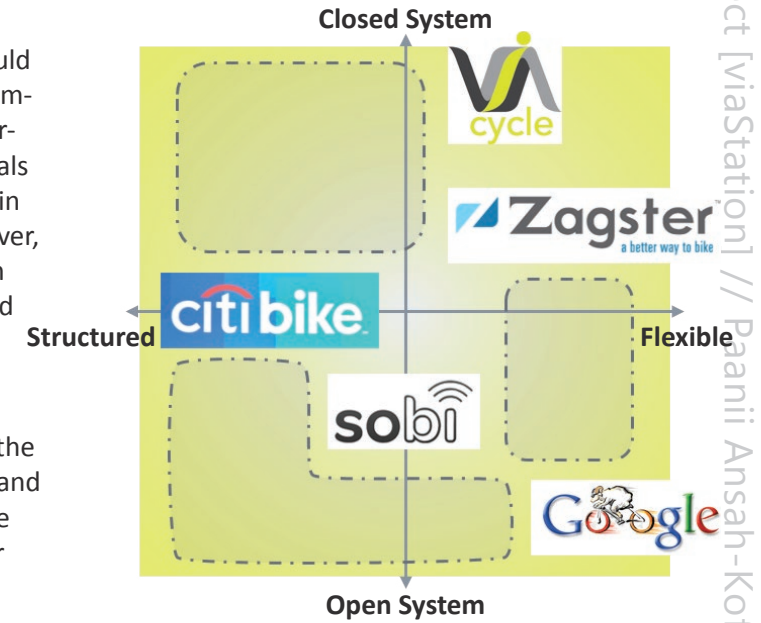


Figure 8: Flexibility versus openness of platforms

viaCycle's 17 quality points pin it as the mid-dling of the pack with 'ease of use', 'service reliability' and 'technology platform' being qualities where, if enhancements are made, it stands to outperform its most challenging competitor, Zagster (18 pts), the most.

In terms of differentiating the platforms as flexible bike-share substitutes, Figures 7 & 8 give an approximate positioning of each in terms of four characteristics that relate more closely to the notion of being 'flexible'. Given the shaded areas represent open market opportunities, it seems to be in viaCycle's interests to explore structural and appeal-broadening innovations.

Project [viaStation] // Paanii Ansah-Kofi // pak3@gatech.edu

- Dieter Rams

Debrief and ideation after meeting with viaCycle, Atlanta, GA



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and challenge the findings from literature. It became important, then, to have some clarity on what developmental milestones each project phase should lead to. The methodology in Figure 9 reflects the basic design process that will be adopted for this project while also highlighting the aforementioned milestones.

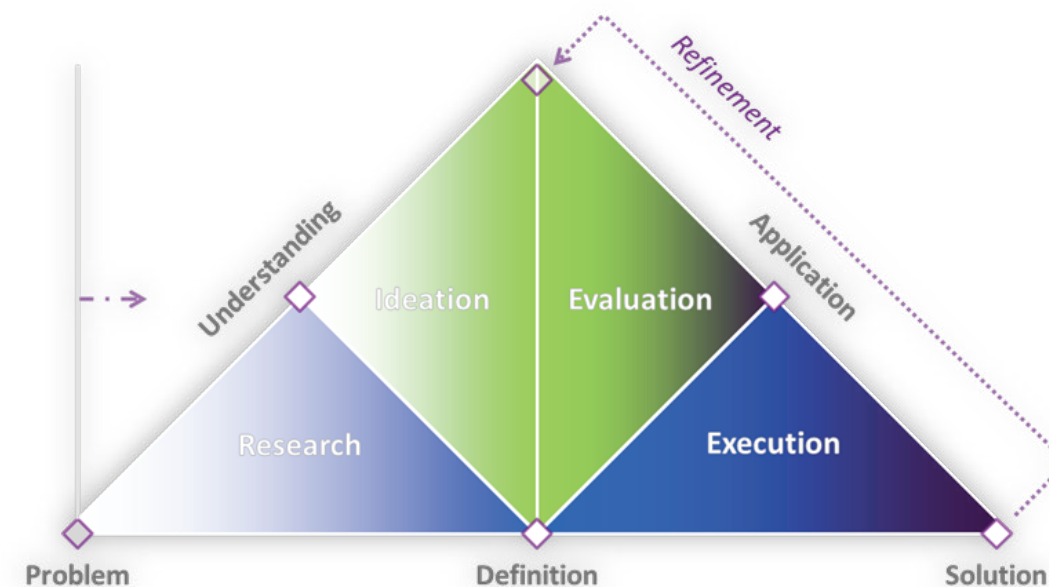


Figure 9: Schematic overview of design methodology

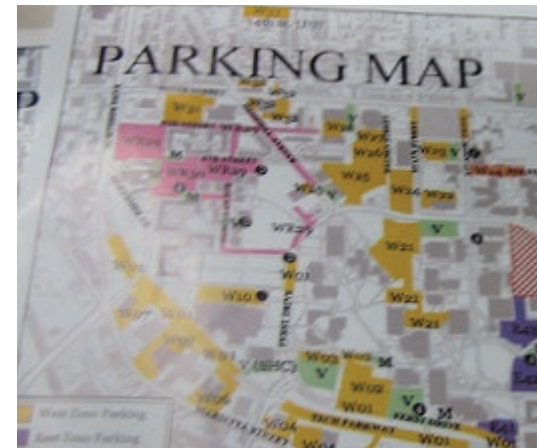
[Note: The previous diagram is loosely adopted from the In2 Innovation Product Pyramid, which is the consultants's proprietary process for strategic new product design and development. This representation of the design process draws primarily from the organization and 'pyramid' layout that was introduced by Brian Roderman, the firm's co-founder, whilst simplifying the flow for the purposes of this project.]

As much of the literature concerns big-market implementations of bike sharing, one imperative of the research will be to assess how much they hold true for smaller markets like the one represented by Georgia Tech, and reasons thereto. To date this has been done by approaching knowledgeable stakeholders involved in cycling activities nearby, and will be continued through the use of a broad survey of potential users who represent target demographics for viaCycle.

Additionally, the frequent news of new campus or property-related bike-shares was tracked as they continue to crop up across the United States due to having to meet and/or ease parking and travel demand. For instance the University of New England & Ripon College went so far as to distribute free bikes to its non-driving freshmen in order to drive down parking demand -- this

resulted in a 50% drop in cars brought to campus by incoming freshmen. Nationwide it is estimated that there are now about 90 universities that offer some form of bike-share program.

Finally, viaCycle and the school's Parking and Transportation department both made a limited amount of transit data available for use in this research, which will support a system analysis of the possible impacts of viaCycle's current and potential service platform.



3.2 User Participation

Interviews and user interactions revealed themselves to be an integral component of the exploratory research, while informing much of the consideration for determining the so-called 'design rules' of the project (see DESIGN BRIEF). The need to improve the service's appeal to novice bikeshare users was an important theme with a majority of the aforementioned key stakeholders.

It was desired to gain up to 50 participants within the Georgia Tech community over the duration of the project.



The plan for user participation had three major components:

1. Two online surveys were given to capture participants' experiences and attitudes to bike sharing; the initial one was a general survey distributed by e-mail at the time of IRB approval, to be filled by a swath of recipients in the Georgia Tech community.
2. Two observation sessions where participants would have the task of using a mock-up of the service interface. The first session would be based on paper prototypes of interfacial screens, while the second would involve an interactive prototype. Both sessions would involve the tasks of,
 - A. registering a membership
 - B. checking out a bike
3. A feedback session with participants was to be administered at the completion of the second observation session where an interactive prototype had been introduced. Apart from the chance to hear critiques on the interfacial design and user experience aspects, it would also be an opportunity to field user inputs for improving concepts.

The nature of this intended user study is such that, because viaCycle's service is only open to credit card-carrying 'adult' users who are 18 and older, only individuals above that age limit will be asked to participate. An adult consent waiver was utilized utilized for in-person interactions. Also, no identifiable information went unprotected or was at any point released to public record.

Finally, all aspects including the observation of practical service usage would pose no more than a minimal emotion or physical risk to any able-bodied user who can ride a bike, and thus allowed the protocol to warrant an 'Expedited Review'.

3.3 Service Design Aspects

Another approach to addressing viaCycle's challenges in courting novice users is look at service design, which is to say, how are operations meeting the expectations and aspirations of every unique rider? It's a task that hinges on the ability to meet the user half way to their end-goal, so to speak, at every system interaction point. Researching the state of the art gave a compelling overview of the existing routes in flexible bike-share but, as always, it is imperative to 'think outside the box' of what exists to truly discover what is possible.

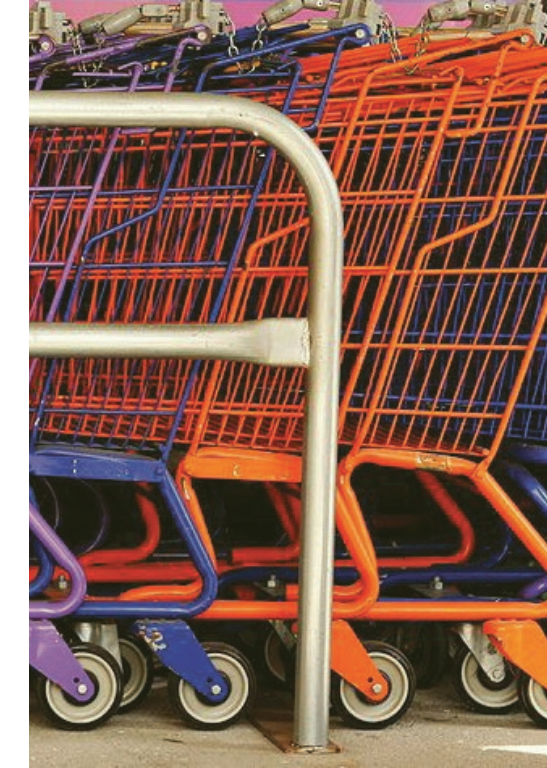
3.3.1 Paying to share'

One start to considering the service design of bikesharing is to recall other 'share-services' that have established the kind of market value that, in their respective sectors, that bike-shares would like to have in public transit. Looking at how they gained the necessary market acceptance, even in sectors that have been around for decades, would stand to shed valuable light on any endeavor to innovate new services.

Example: Compact shopping carts

These weren't always a given amenity at your local food mart. While there had been a sheer ploy for you to part with more of your money -- bigger carts, bigger revenues -- the offering of compact shopping carts right alongside the big- or regular ones is one example of a service design for sharing that's geared towards benefitting the consumer while helping the bottom line. For this case, the more visible, plentiful and even-distributed the carts are, the more shoppers feel their particular needs have been met, the more money they're actually *willing* to spend.

Product performance is an obvious driver of market acceptance but, more often than not, it requires the compliment of an effective service design to get there and/or maintain market value. One need only consider the once-opposing trends in the popularity of diesel engines in cars in the US, with its limited service/regulatory investment, versus in the EU where in some areas they are quite ubiquitous.



3.3.2 Gaining acceptance

The process of gaining market acceptance for products or services that are shared is especially crucial in the present-day global economy where the prevalence of automation and manufacturing abundance make it prohibitively difficult. As such, it makes sense to consider the three constructs of the so-called 'customer journey' over the duration of a service as they relate to bike-share.

1. Expectations

A big misconception about a user's expectation would be to say that it is wholly unpredictable, or even just down to the person's mood or personality. A service's design language, its reputation, and the word-of-mouth from previous users play big roles in the ability to mold the expectations of customers both old and new. For viaCycle, a new kiosk product with explanatory signage or inviting aesthetics would be instrumental in guiding immediate pre-use expectations, but on its own it might not influence much more than that.

2. Experience

This is where the magic happens -- at least it's supposed to. It's the service's fleeting opportunity to leave its purest impression on the customer. In the case of viaCycle (or any modern public bike-share, for that matter), it is paramount that the service be viewed as being similarly practical and as easy to use as your personal vehicle, if not more so. One thing for sure: it should offer something characteristically new and forward-thinking, both as a bike-share and as a Georgia Tech affiliate.

3. Satisfaction

Coming out of a service experience puts much of the sway of public perception back in the hands of user, who are entitled to the free speech on any and every option they may have. Not surprisingly, the customer's level of satisfaction ends up feeding into the expectations of others who are new to the service. For a campus that is still relatively new to bikesharing, it's critical to give novice users a highly satisfactory first-time experience in order to maximize its membership.

The three of these constructs are well documented by filling out a Customer Journey Canvas, a widely-used design tool for evaluating service designs. This and other approaches for visualizing points of service interactions with the user were used to help strategize the most promising solutions that might work in tandem with proposing a novel kiosk design.

3.3.3 Transit data for Georgia Tech bus system

Beyond having another selling point to prospective students on its transit amenities, Georgia Tech's motivations for implementing the bike service also stem from the practical endeavor to help support the transit demand. Therefore, considerable effort went into evaluating the capacity for extending the use of the school's transit network. Ultimately it would aid in leveraging potential solutions for viaCycle's accessibility needs, in order to reach or improve on those impacts.

Having insight to the distinct operation strategies and data has informed approaches in this project's research. as well Figure 10 shows an overview of last year's data in terms of bus stop activity, where residential-area stops were especially busy. With this outcome the question becomes, how best might viaCycle draw in students who don't regularly use the transit network to begin with?

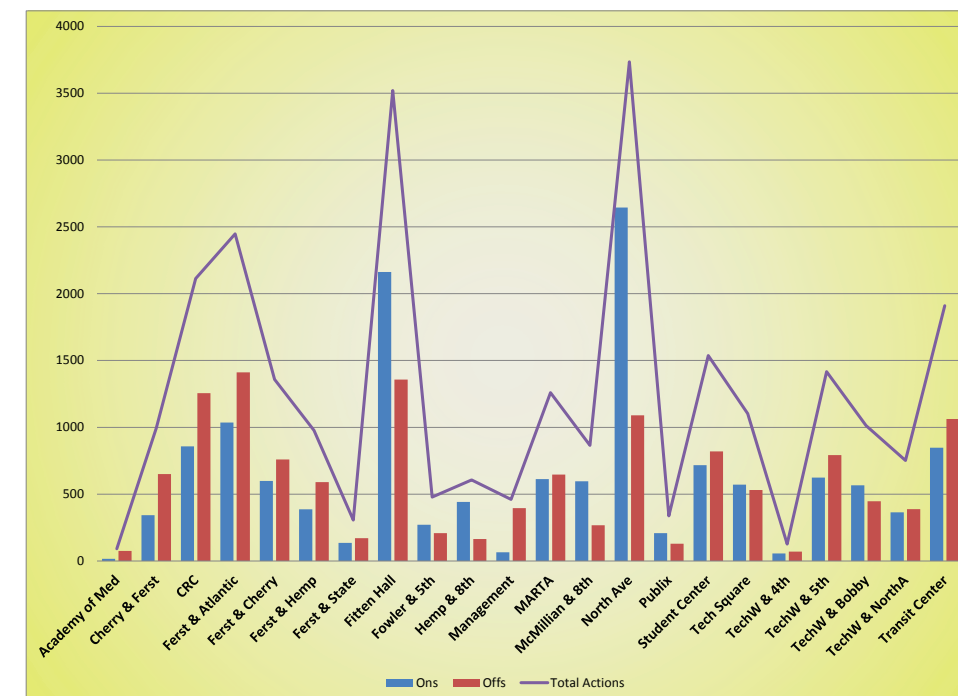
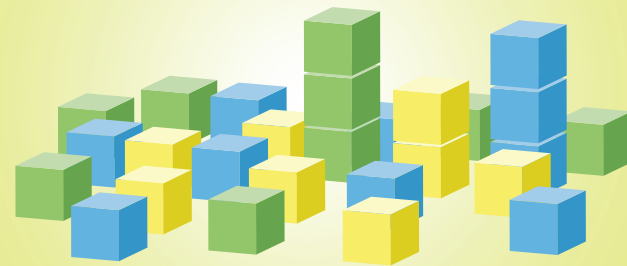


Figure 10: 2011-2012 Ridership for Red-, Blue- and Tech Trolley routes

- **Stakeholder consensus on raising the profile of bike-share**
- **Surveys indicate a dearth of students who are bike-share regulars**
- **Assessment of the viaCycle social flow model**

4. RESEARCH FINDINGS



4.1 Expert Interviews

4.1.1 Amy

Amy Ingles of GT's Students for Progressive Transit organization on campus observes that while bike ridership in Atlanta is experiencing positive growth, even many enthusiastic cyclists have limited knowledge on the use of bike sharing for everyday travel. That said, she would be interested in being able to the service in the same way that she uses ZipCar, a service that she welcomes "as a liberation" from the onus of maintaining a private vehicle.



4.1.2 Johann

Georgia Tech student Johann Weber of the Bicycle Infrastructure Improvement Committee, meanwhile, sees cycling culture as a good precedent for bike-share culture. He also notes in cases where users are complete beginners that "confidence is a game-changer", and so being able to draw them to just a positive first experience can have notable effects on accelerating adoption.





4.1.3 Aaron

One key stakeholder who periodically still influences the implementation of viaCycle's service, Aaron Fowler of GT's Parking and Transportation, revealed that the (re)designation of a viaCycle rack to a highly visited Tech Square location was very deliberate toward helping introduce the service to the many first-time campus visitors in its vicinity. This presents an interesting opportunity for the kiosk design to be considered as more of a central access/orientation option as opposed to the oft-travelled distributed networking route.



4.2 General Survey (Online)

This group, solicited via e-mail link, had an expectedly high proportion of individuals with little- to no prior experience with riding the service. However, with a respondent group adding up to only 38 survey-takers, it would be a stretch to take any of the following response summaries as generalizable data for the entire Georgia Tech community. For one, the survey was disseminated using an e-mail list of students and staff from only the College of Architecture. That said, the numbers summarized here do point at trends that are corroborated at least in part in sections either following or prior to this section.

All responses relating to student participation in viaCycle's bike-share service would indicate that more needs to be done to draw in the wide swath of uninformed yet walk-happy students (Figure 12). Many of this group are also proponents of the traditional transit services (Figure 11) but may have not tried viaCycle due to being *under-informed* about the service (Figure 13).

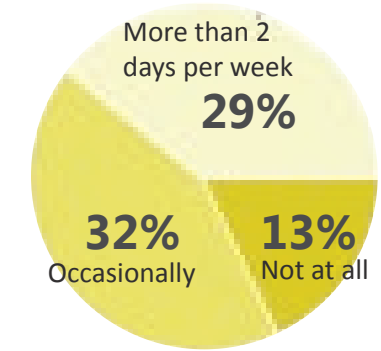


Figure 11: Do you ride the campus trolley or shuttle services?

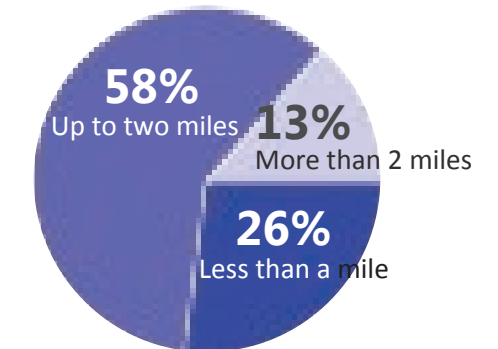


Figure 12: Roughly speaking, how many miles do you walk to get around campus daily?

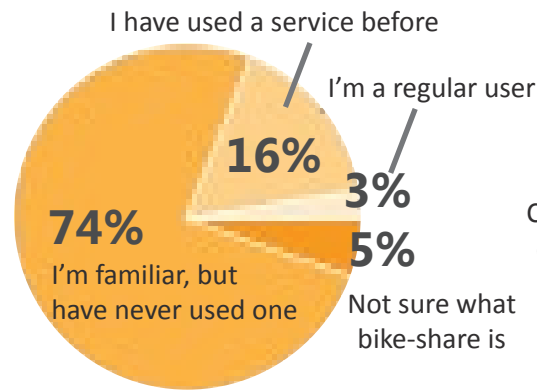


Figure 13: Which statement best represents your familiarity with bike-sharing?

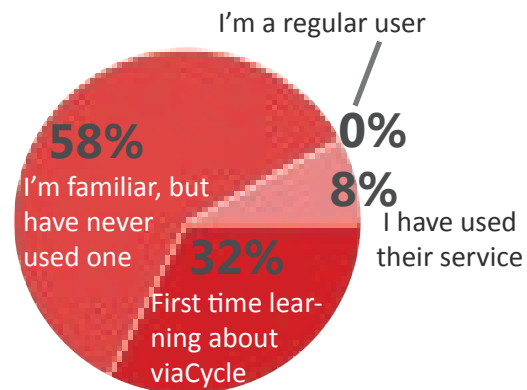


Figure 14: Which statement best represents your familiarity with viaCycle?

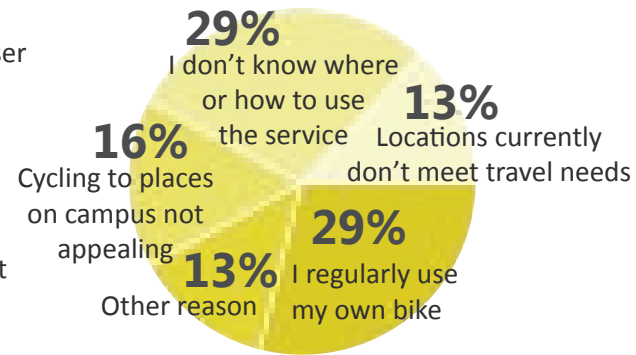


Figure 15: If you HAVE NOT used a viaCycle, why not?

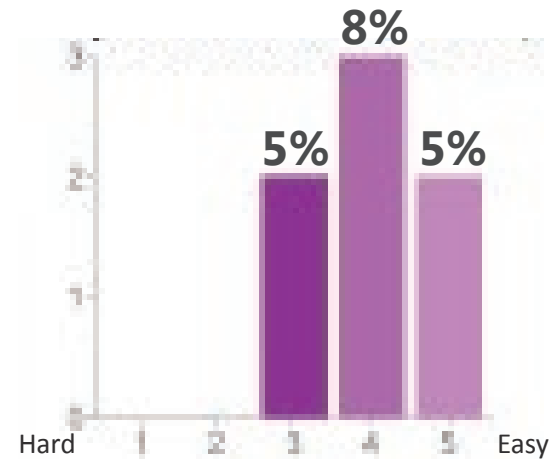


Figure 16: If you HAVE used the service, how would you rate the general ease of use?

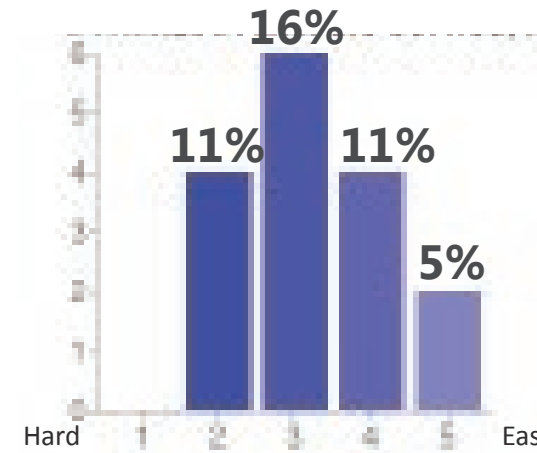


Figure 17: If FAMILIAR with the service, how would you rate the availability of bikes near locations of interest to you?

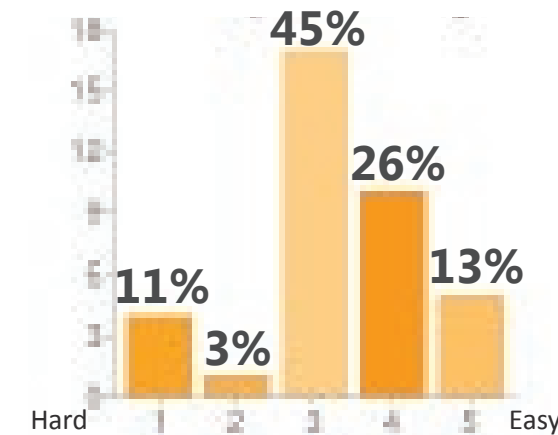


Figure 18: How would you rate the general ease of use of modern (touchscreen) kiosks?

The response on why 9-in-10 respondents haven't used the service (Fig. 15) is especially enlightening. In an even split of responses, the majority hadn't used the service either because they didn't know enough about it (29%) or because they regularly use their own private bike (29%). While the prior response confirms the hypothesized lack of information visibility, the latter serves as stark affirmation of existing cycling culture at GT's campus that needs to be complimented by viaCycle.

The platform gets good marks on its ease of use, which it also had going for it in comparison to other flexible bike-shares. However, it would seem that knowledge of the system overview and the distribution of its racks in particular is still lacking. A singular kiosk product would be capable of beginning to address these, but whether it can do the above *well* and maintain its streamlined, task-oriented core functions of handling checkouts deserves more exploration.

Apart from gaining these insights into user interactions with the existing platform, this study has in the next sections interpreted these feedbacks versus the available data to begin the development of a future accessibility strategy.

4.3 Service Design Assessment

4.3.1 Operator perspectives

In meetings with Kyle, viaCycle's CEO, he has expressed their longer-term goals to bring their offer of sustainable transportation to areas that need it most; he even pointed out lower-income regions as a future target. More recently viaCycle's operations have taken turns to be able to lease out the platform as an all-in-one bike share that can be widely implemented, most notably by launching a pilot service in greater San Francisco some weeks ago (this has since shifted to Las Vegas, NV). Aaron, meanwhile, appears to see the service as a discrete tool for alleviating the load on the campus' road/parking infrastructure and for expanding the transportation options of students in particular.

Between these perspectives there seems to be some risk of the two sides enacting strategies that may not align in the same geographical context, so it's important that a viaStation solution is grounded on an appreciable consensus on operations at Geor-

gia Tech. Such stakeholder interactions are also building knowledge on the preferred channel(s) by which to approach target users; talking to viaCycle technicians Yuriy and Oleh, for instance, yielded unique insight to more of the logistical determinants for what can and can't ultimately be broadly implemented for enhancing user access.

The ridership data that has been shared by GT's Parking & Transportation to date (Figure 10) for the local bus- and trolley services has informed the project on the distribution of travel volumes throughout the transit system, and has helped in gaining insight to the potential locations where the stations would be particularly beneficial in easing demand. Such invaluable qualitative data will continue to be gathered through until the development of design concepts.

Understanding the major themes and heuristics for evaluation are important immediate

deliverable for the current phase of research. This will help approach a comprehensive definition of the project scope. The method for achieving this will be centered around both qualitative and quantitative frameworks involving the service, in a conceptual manner; such plots like the one above, whether in the form of more design tools that shed light on the most pertinent questions of 'what, why, when and how'.

Below, Yuriy uses a tablet PC to track bike data and identify connectivity issues, or to see which bike(s) will be up for battery replacement sooner than later.



4.3.2 Social Flow Diagram



In recent years there has been much progress in utilizing networked media or cloud computing to drive adoption rates for shared services. Surely there is another, more interactive social flow to be achieved based on innovations proposed in this project.

4.3.3 viaCycle User Survey

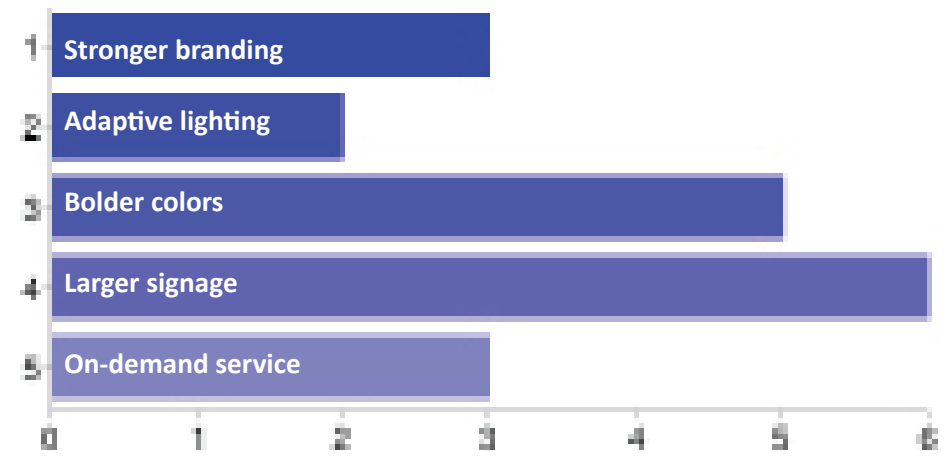


Figure 19: In your opinion, which of the following features would best improve the visibility of viaCycle bike locations? (1 = most improvement, 5 = least improvement)

These findings from an internal survey that viaCycle allowed me to direct as a follow up to the general user survey uncovered some very specific takes on the visibility of the bike-share system. First, in Figure 19, the noted enhancements that current users would see driving the best results would be to have larger signage at the designated stations, with bolder colors and on-demand service rounding out the wish list. Also, the users corroborated Aaron’s assertions about the Barnes & Noble station being the most high-value placement within the network to date. Lastly, respondents seemed keen on being more proactive with account management (Figure 20), which goes along the same lines as wanting on-demand services.

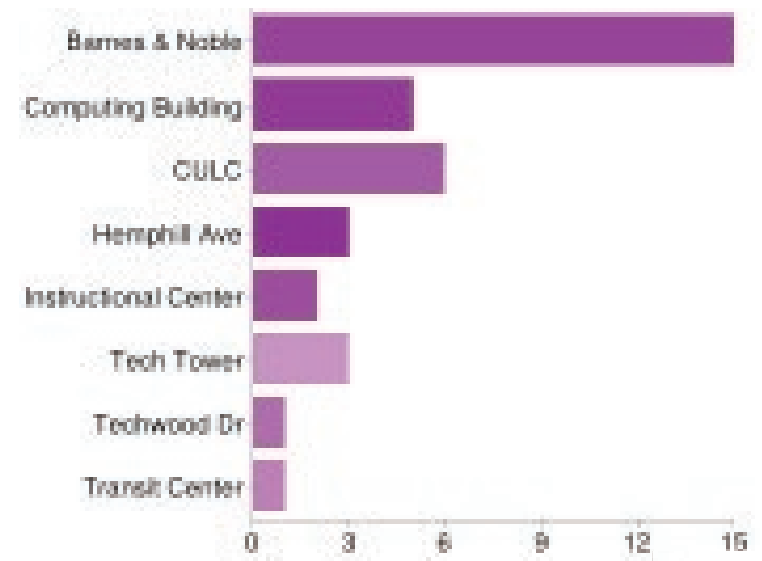


Figure 21: Which of the following stations would you have seen first when first visiting Georgia Tech?

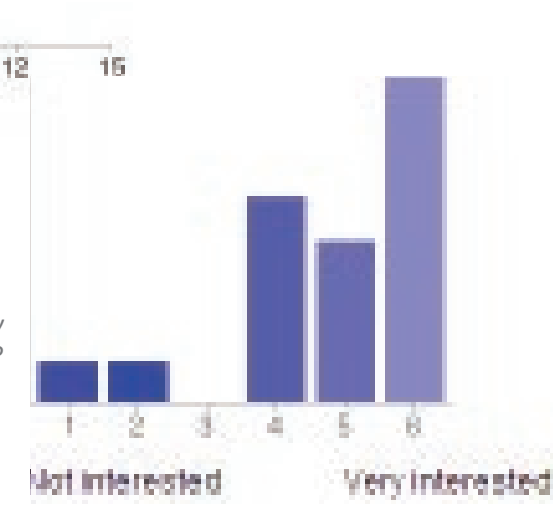


Figure 20: Please rate your interest in being able to view or manage your viaCycle account or activity before and after bike trips?

- Hierarchical breakdown of desired functions
- Establishment of design rules for successful viaStation solution at GT
- Consideration of criteria and time



5. DESIGN BRIEF

5.1 Functions

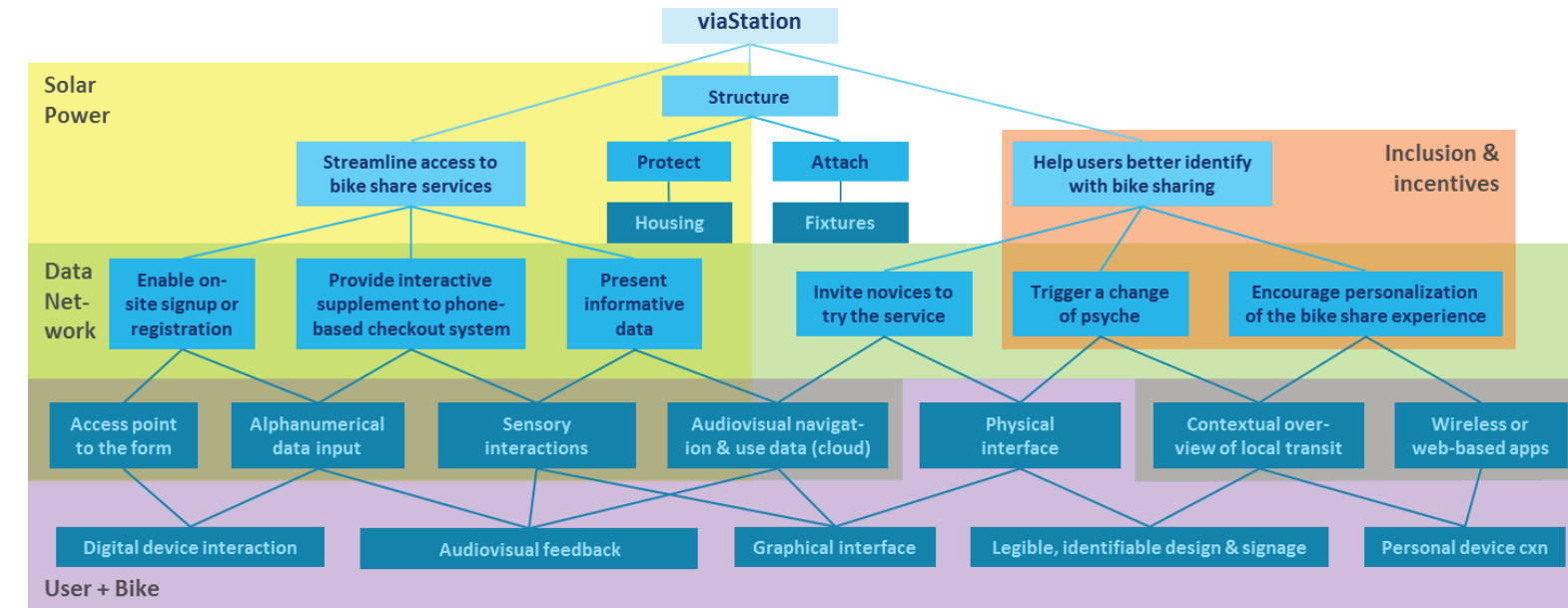


Figure 22: Function diagram for prospective viaCycle Kiosk device

The above diagram shows, comprehensively, the functions that would be supported (remotely or otherwise) by the proposed viaStation solution in fulfilling the previously stated project intents outlined in Section 2. While it's apparent that some functions would be more 'tangible'/easier to assess than others, the functions at each respective level speak equally to the imperatives for offering this particular service enhancement to the viaCycle platform. The functions falling under the left branch that help streamline access to the bikes would be tied more to the physical kiosk and on-site tasks, while the right branch outlines more of the system's 'cloud' interactions that seek to reinforce the sociocultural relevance of the bikeshare service.

5.2 Rules/Goals

The following “rules” represent the overarching goals for the proposed system while the objectives point to aspects where each could be measured for success. They also reflect key findings from the research that point at ways to advance flexible bike-share at a place like Georgia Tech.

RULE #1

Design must invite bike share novices to try out the service

Objectives:

- Draw attention to the service’s presence
- Incorporate educational queues, an overview of the service
- Enable map localization

RULE #2

Design must trigger a change of psyche among the student community concerning the use of bikes as an everyday transportation option

Objectives:

- Incentivize regular use and/or participation
- Streamlined integration with the extended transit infrastructure, including possible off-campus connections and MARTA services
- Provide local transit information, feedback

RULE #3

Design must help lower the barrier for modern bike share implementation

Objectives:

- Necessitate as little infrastructural cost as possible
- Self-powering design, probably solar
- Preserve the usability of existing bike infrastructure, especially racks
- Satisfy major property regulations relating to outdoor structures

RULE #4

Design must liberate the user in managing the service experience

Objectives:

- Enable social media integration
- Incorporate storage, transmitting of (unidentifiable) service use information
- Present contextual bike data

5.3 Criteria

The following represent key criteria concerning the major aspects of the kiosk system and supporting features.

Sustainability:

- Having a use-cycle for the housing and components of the primary unit that outlast the duration of the technological state of art for bike sharing
- Using durable, reclaimable materials for structural needs
- Sourcing power from renewable, off-the-grid source
- Preserving as much conventional bike-rack utility as possible

Appeal:

- Appealing to young adults who are still feeling out their transit options
- Instilling confidence in novices who may have never before used a bike share service
- Encouraging individuals who are considering a switch from commuting by car on a daily basis
- Supporting new and existing bicycle culture

Market:

- Helping viaCycle become the ZipCar of bikes: offer the utility or piece of mind of a bike that is functionally separate from my own

- Costing far less to implement than a similarly-sized 4th-gen service that uses contemporary kiosk infrastructure, like D.C.'s Capital Bikeshare
- Supporting users' desire for added freedom, flexibility of use
- Making up the lack of an infrastructural presence with a cultural one

Ergonomics:

- Situating the major unit and interaction points at appropriate heights
- Enabling quick and easy reach for all necessary tactile controls

Function:

- Enabling on-site signups and payments for the service
- Wireless connectivity that is seamless
- Ensuring day- to-night operability
- Maintaining adequate power supply during over-cast weather
- Providing near-instant feedback to user inputs
- Interacting with feedbacks that are unimposing
- Presenting service data in a manner that is easy to appreciate
- Powering a backlit screen and/or signage
- Helping to deter bike thefts and vandalism

Physical:

- Being tall enough to command an obvious presence at busy, cluttered bike racks (also from a distance)
- Inviting interaction independent of the specific

orientation

- Incorporating robust weather protections of interfaces and components
- Using high-strength fittings for all joints and assembly
- Attaching very securely to several types of bike rack
- Theft-proofing all major components

Manufacture:

- Using a high-strength housing material that is easy to cast or mold
- Minimizing cast or mold complexity
- Minimizing number of cast or molded parts per unit
- Incorporating a skeletal aluminum frame or similar to reduce mold material
- Matching material density, thickness to strength requirements

Aesthetics:

- Keeping a sleek profile
- Utilizing simple but refined interfacial details
- Evoking a feel of futurism and advancement
- Incorporating an eye-catching amount of 'viaCycle green'
- Agreeing with the form language of existing viaCycle bikes
- Achieving a clean, consistent surface finish
- Making interaction and data presentation a focal

point

- Minimize visibility, prominence of fixture apparatus

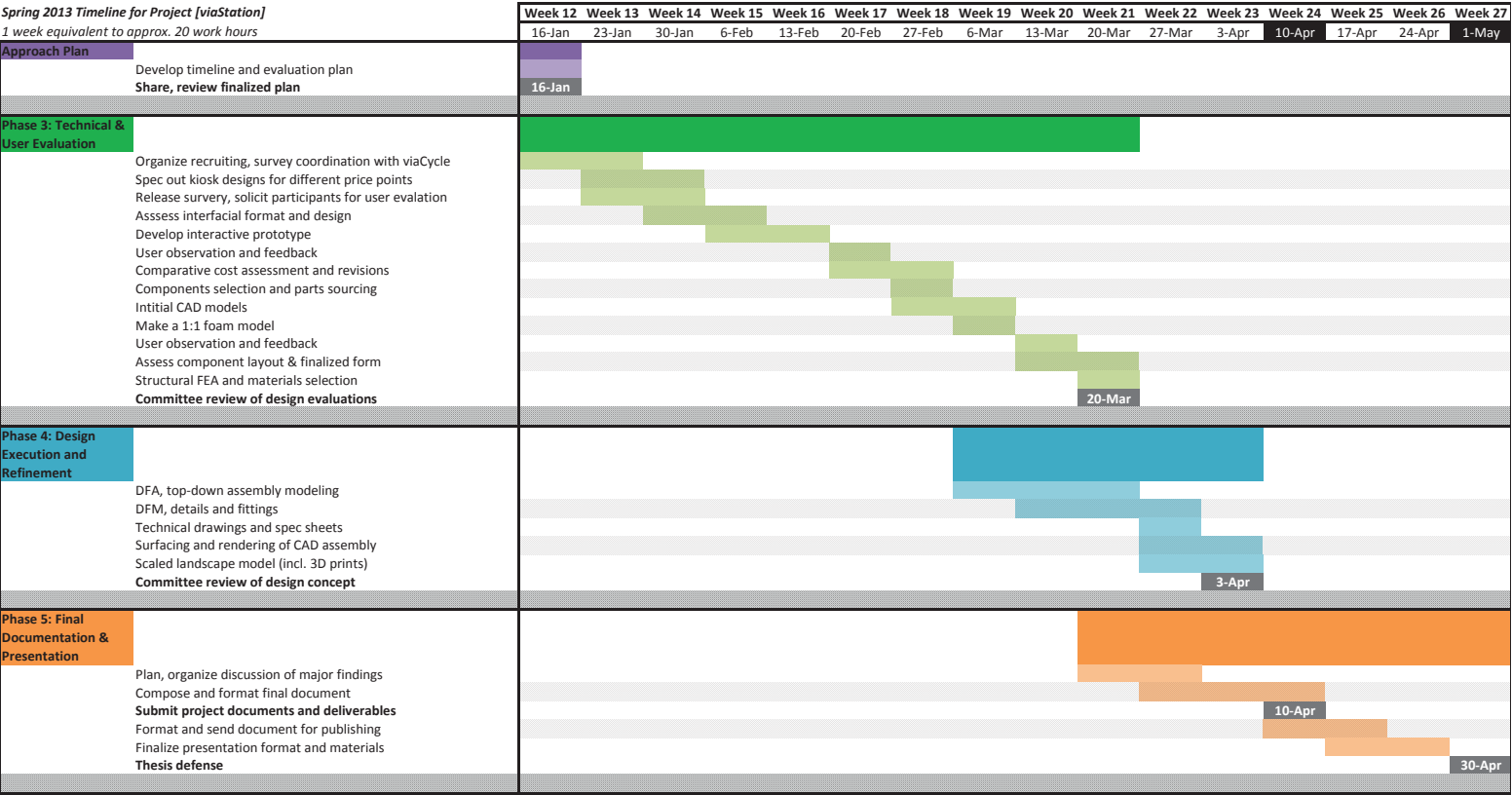
Implementation:

- Meeting campus regulations for placing structures on property
- Installing viaStations at rack locations with a distribution that best influences the service's impact potential
- Securely fixing the major units on or around existing bike racks
- Being able to use a mix (as needed) of local and international distribution channels for parts acquisition
- Pilot running manufacture initially in the U.S. to best review scaled manufacturing aspects, before considering overseas options

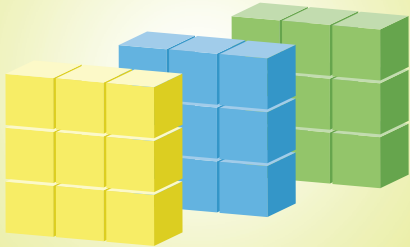
Cost:

- Limiting the BOM cost per viaStation to the current cost of two viaCycle bikes and a CRM software license, or less than about \$6000
- Eliminating the need to for any site construction whatsoever
- Minimizing the need to maintain property use permits
- Minimizing the need for professional installation
- Sourcing components that represent the best value for money

5.4 Spring 2013 Timeline



6. DEVELOPMENT



- Overview of task flow
- Concept ideation for kiosk hardware
- Evaluation of concepts
- Prototyping of physical and digital interfaces

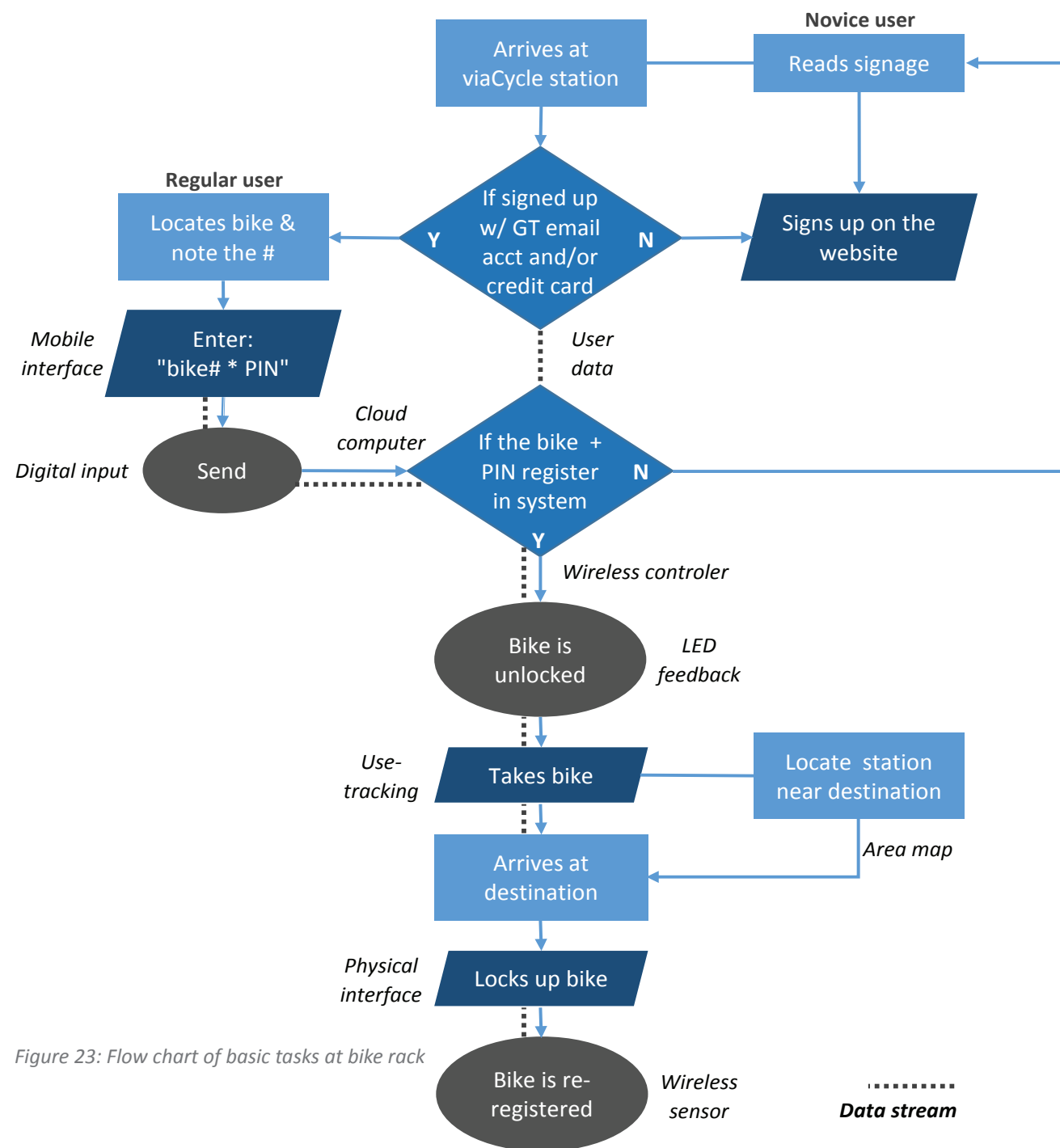


Figure 23: Flow chart of basic tasks at bike rack

6.1 Task flow overview

Initial developments were centered around gaining an overview of the core tasks that the proposed solution would seek to enhance or, at the very least, maintain at any given viaCycle service rack. This step would inform a number of key considerations including the main affordances, features and interaction points throughout the system.

Opposite, Figure 23 gives a basic look at the use sequence for any prospective user looking to get from point A to point B using the existing bike-share platform at Georgia Tech. Users are represented as being either 'regular' users who've previously signed up for the system, or 'novice' users who, in this depiction, are seeing the service up close for the first time.

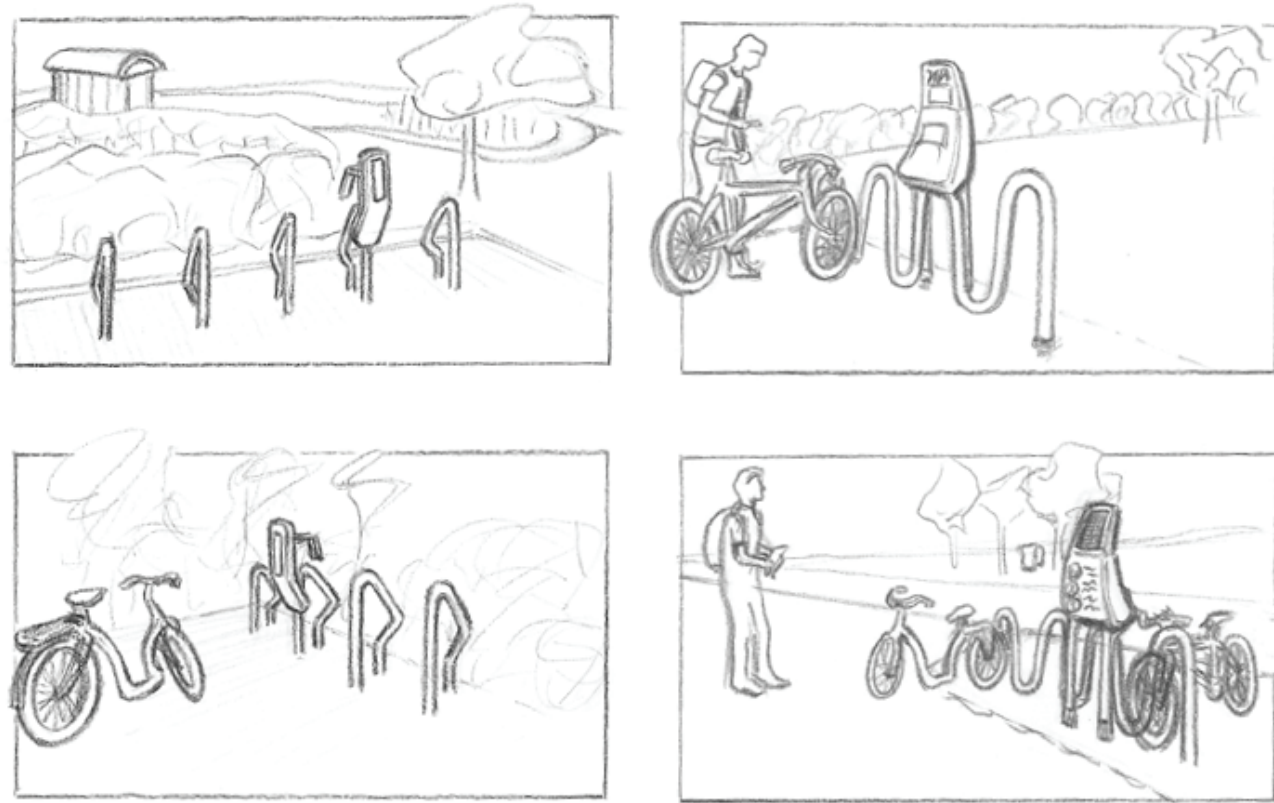
Also indicated is the data stream of user inputs and system outputs, which are all managed wirelessly by the cloud. Currently the major interfaces for these are the user's mobile device and viaCycle's proprietary electronic lock, respectively.

Most striking is that the basic use for the novice user at the site of the bike rack practically ends at reading the signage, at which point they realize the need to pull up the gt.viacycle.com website and signup. This can happen on-site if they have a smartphone or other wireless computer, but the process is more arduous than many would be willing to complete then and there, especially if they stumbled upon the service en route to somewhere else. An equally likely case that is just as likely is that the novice notes the website for getting signed up later.

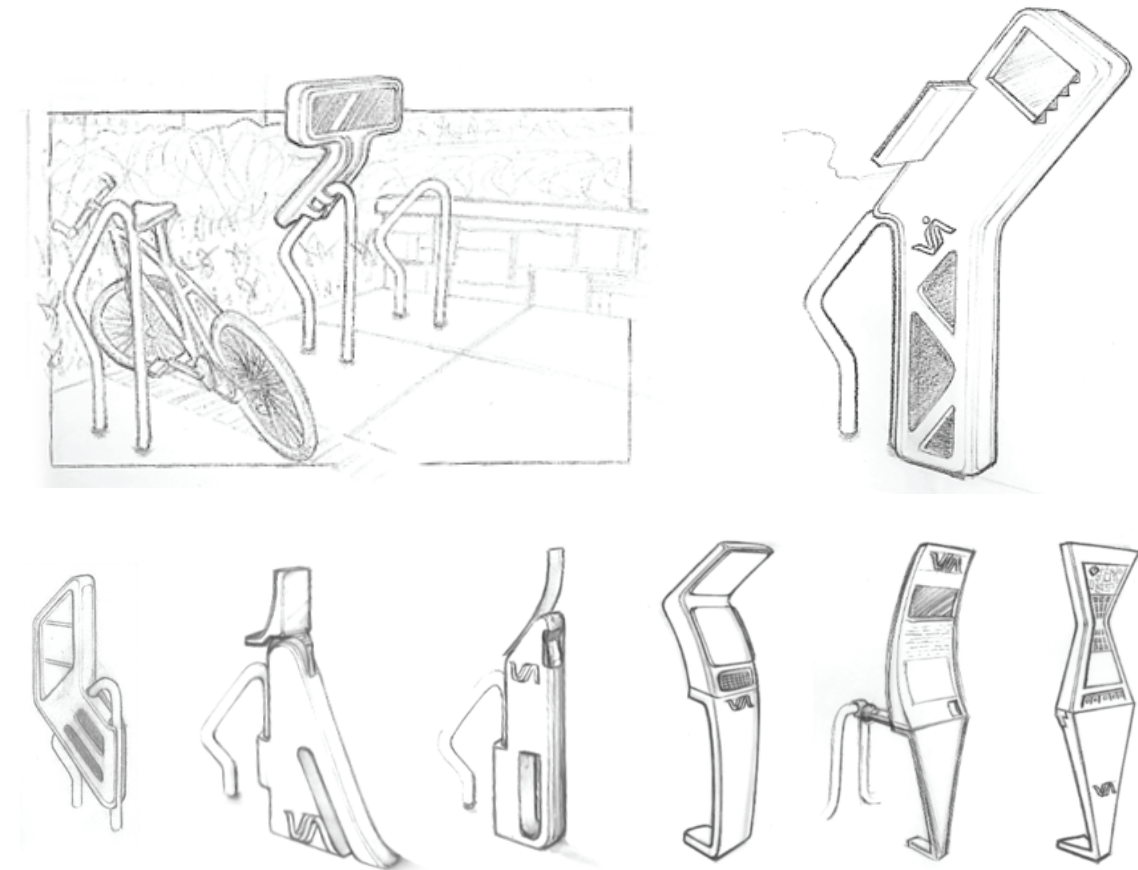


Early prototype of viaCycle e-lock technology

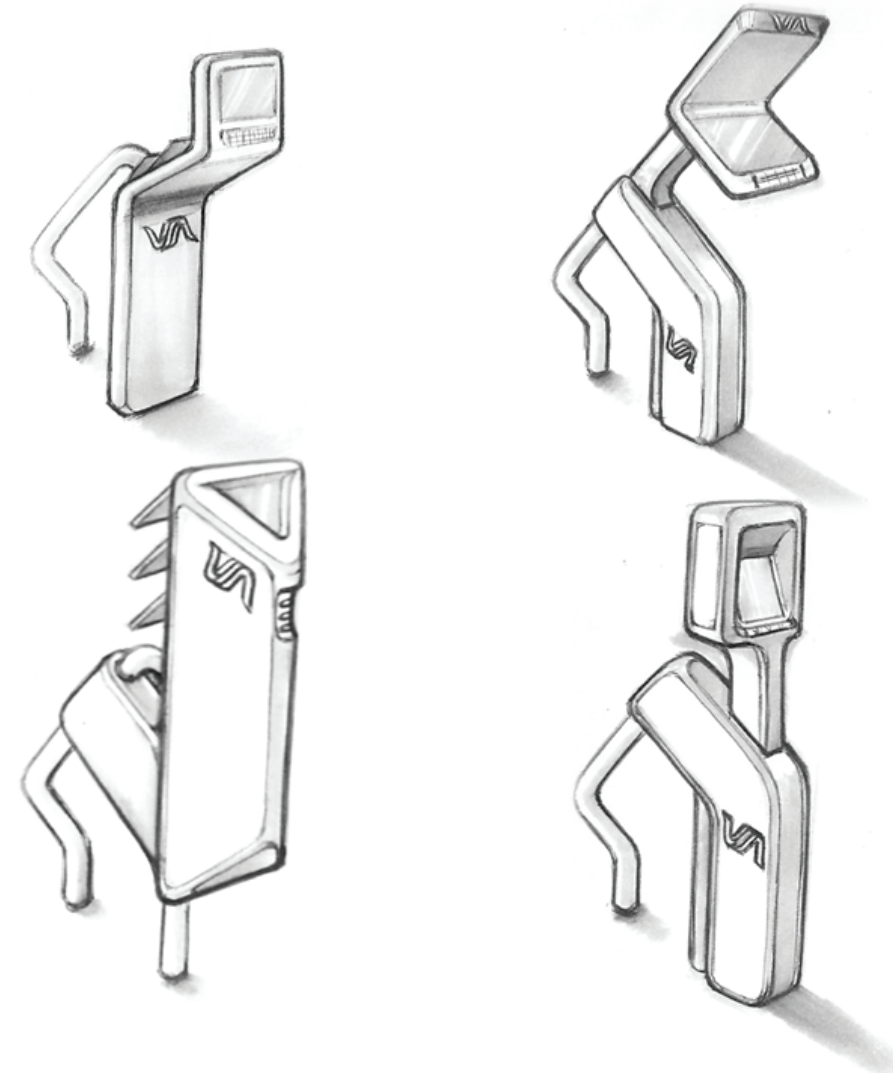
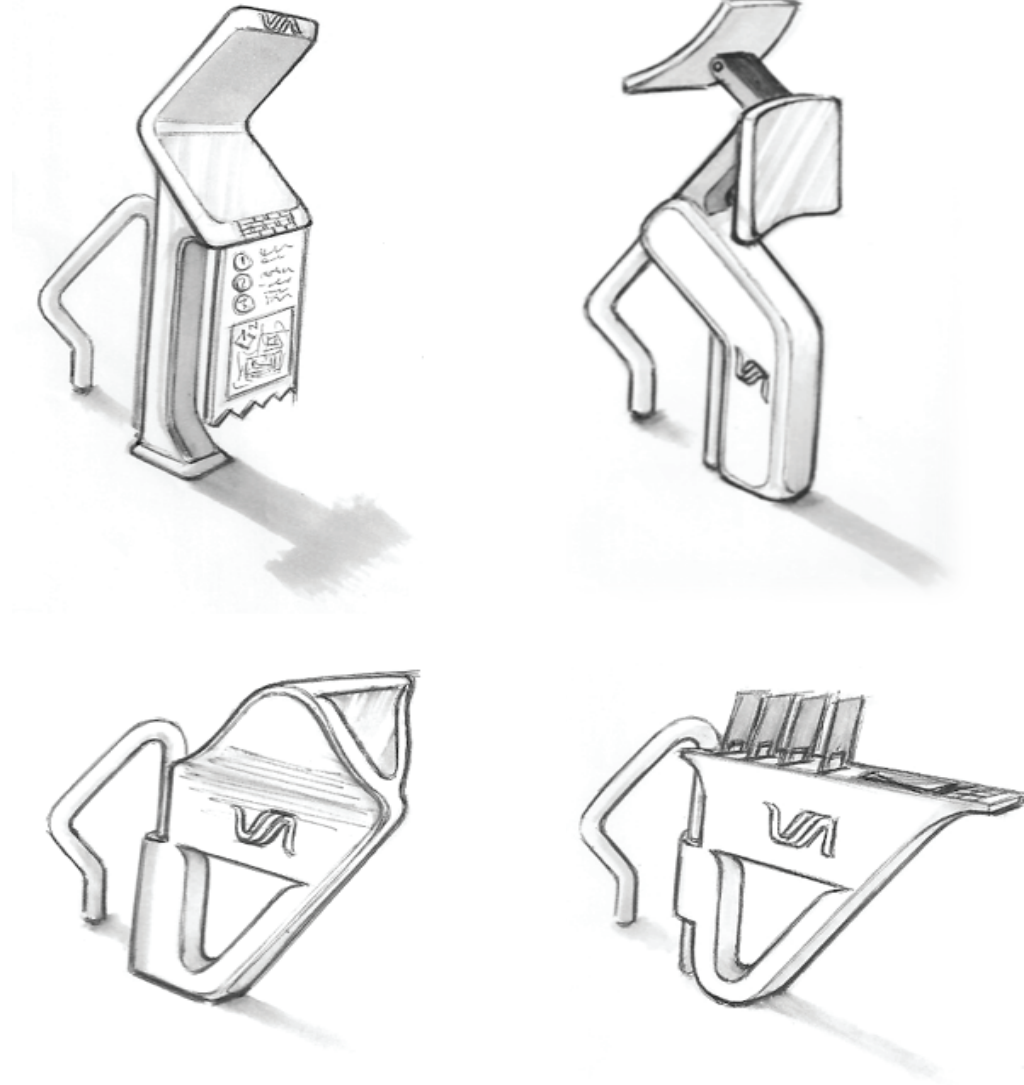
6.2 Hardware Ideation



As seen above, ideations began with considerations of the immediate use environment, including the physical parameters around situating the device at existing, publicly used bike racks.



Looking at the different racks necessitated some ideas surrounding the stance and points of attachment on the device's structure.



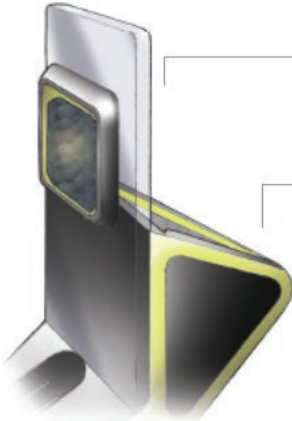
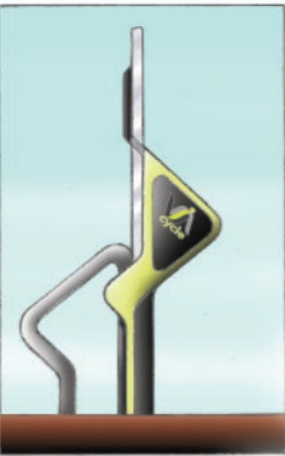
Given the 't-rex' rack is the most ubiquitous of the bunch, it was worth exploring the various form integrations around it; achieving a suitable size and effectiveness of the screen interface seems problematic.

6.3 Hardware Concept Directions

viaStation Theme 1: Unmistakable Branding



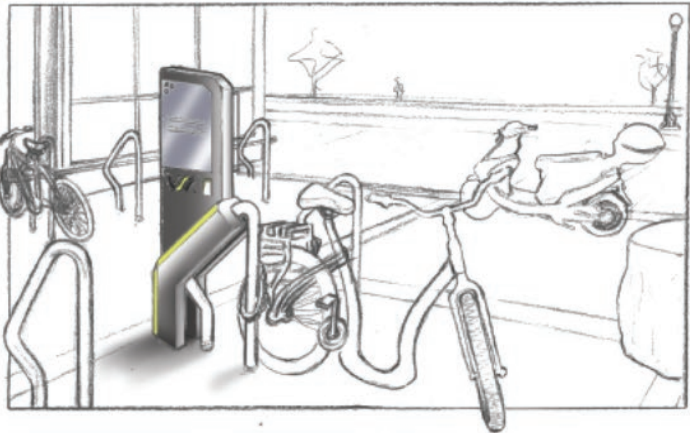
A concept that pushes branding queues using a proprietary interface format, among other possible features, to be recognizably viaCycle-affiliated.



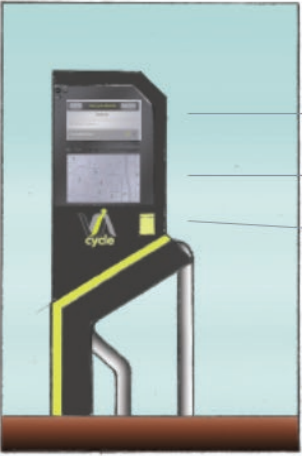
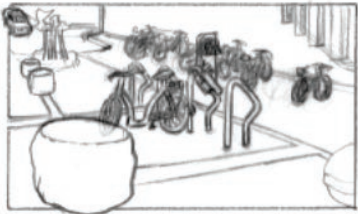
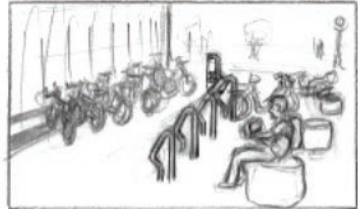
Solar power module

Touchscreen control interface

viaStation Theme 2: Contextually Appropriate



A concept whose form adheres to the immediate environment, which in this case includes the CULC and its tall window panes. It implies having some variation in the station design across campus.

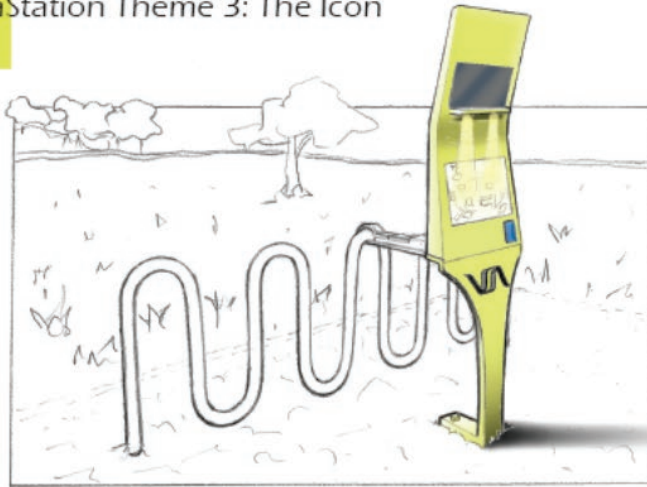


Touchscreen

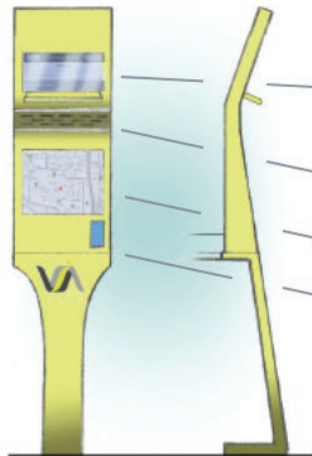
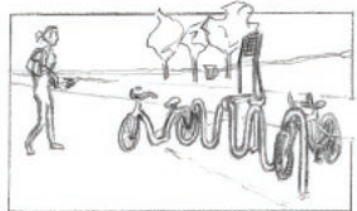
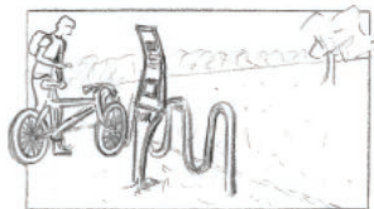
Dynamic map display

RFID card reader

viaStation Theme 3: The Icon



A concept that utilizes its bold colors and tall, advancing stature to announce to all passersby that, Here Stands a viaCycle Station. Also, the fixture would attach to a range of rack types around campus.



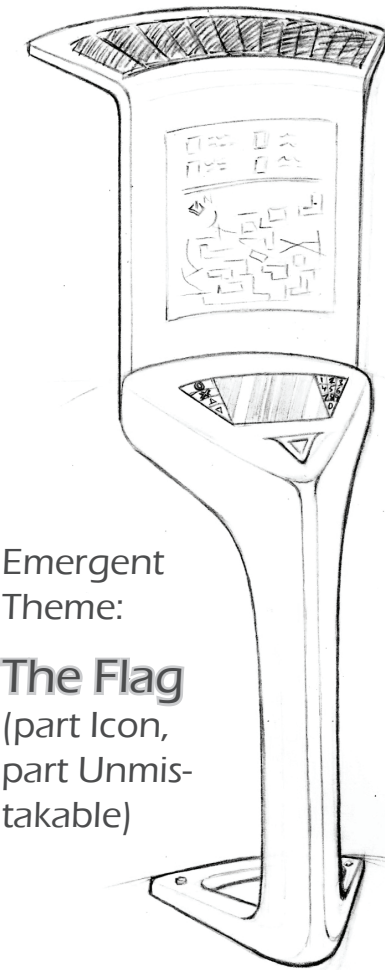
Display that cycles use-information and tips

Speaker/mic

Static map

RFID card reader

6.4 Hardware Concept Evaluation



Emergent Theme:

The Flag
(part Icon, part Unmistakable)

The following insights came from key stakeholders when these three major concept directions/'themes' were presented for feedback and evaluation:

- Attention-drawing aspects like those shown especially in the 'Icon' concept are particularly high value; this was emphasized by both viaCycle and Georgia Tech Parking and Transportation
- Both a touchscreen and a static map should be incorporated for quick-takes as well as deeper information; viaCycle
- Adjustable fixtures for variations in rack height due to installation should be considered; Georgia Tech P&T
- Need to ensure materials and features preserve the security of expensive parts and components
- A touch interface that also runs video would present an especially interesting draw-in for more casual on-lookers who are discovering bike-share for the first time; Amy Ingles

One takeaway was that sheer visibility and ease of use would be paramount seeing as they have so much to do with that all-important first impression for the novice user. The bigger one may have been that both parties were very receptive to the idea of having a feature-filled variant of the kiosk -- a flagship kiosk that would be along the lines of 'The Flag'.

6.5 Human Factors Assessment

6.4.1 Ergonomics

Considering the ergonomics around such viaStations some evaluation would need to be based in the affordances of the interfaces that lend themselves to making the user interactions comfortable. Just amongst the three prior concepts directions, there are representations of three rather divergent ergonomic experiences, with the Flag concept resembling the ergonomic parameters of both the Branding and Icon themes.

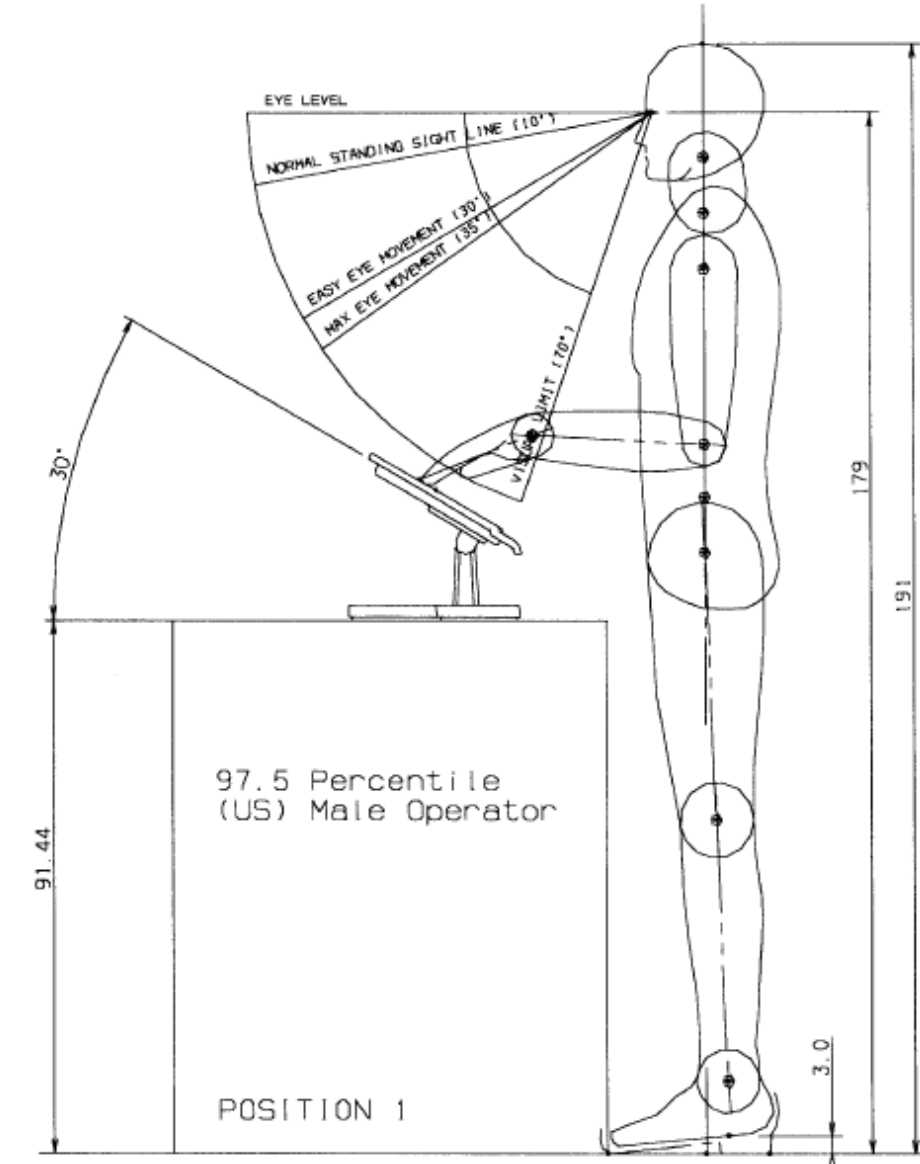
For the low-set interface of the emergent Flag concept, there will need to be consideration for anthropometric elbow and wrist heights so as to prevent any extreme flexion at user's wrists as they make inputs via the screen. 3 ft is often used conventionally as the height to have as a standing resting point to one's hands, whether portable or stationary. However, with an integrated screen, a concept like The Flag would need that the surface to be at a higher, more intermediate point to satisfy as a screen.

6.5.1 Viewing angles

The touchscreen display component of the viaStation indeed puts the consideration of the ideal viewing angles front and center of the interactive design's success. Right, we have a schematic of the 97.5th percentile US male interacting with just the type of touchscreen display being considered here.

Shown are the boundaries around a 60-degree viewing angle through which the user's sight is a normal range, so it would seem that the height of the screen shown is quite at the low end for accommodating the taller people the system seeks to include.

Apart from screen height, its tilt would also be an important parameter for the accurate transmission of visual information. Being lower set, the display angle on the emergent concept would be similar to the 30° depicted at right. With the directive to play up the visibility of the viaStation though, it would make sense to expand the viewability beyond the attending user. As such the screen height may well have to be revised up.



6.6 Physical Mockup

It was assessed that making a 1:1 scale physical mock-up be invaluable towards becoming informed about the spatial format of the proposed kiosk device. Seeing as there was some interest in having the option of incorporating onto the 't-rex' bike rack itself, it was also especially good to see how well that setup would pan out or not.

Foam core board material was used for the purpose of quickly and efficiently producing a structural base resembling the 'Flag' concept, albeit with a number of simplified but non-essential aesthetics. The completed model stands about 4.5 feet tall.



Before



After

The study model was subsequently taken on site of an existing viaCycle rack location (dubbed the 'Transit Center' station) to validate its visual as well as physical integration. Above, the pictures show the station as it is without a prospective viaStation and how it make look after. While the model indeed sat on the t-rex rack rather well, it was found to create the visual reference point as a public service station a bit better when it stood just a bit off on the side.

At the same time there was attention given to observing passers-by for their interest and curiosity in what service, if any, the new interface seemed to signify. Out of the four students asked only one student, who had previously checked out a viaCycle there before, guessed exactly right that it would be a display to support the bike-share, but the general association to bike-share did appear to come across (other guesses included a bike, and lock-rental systems). Though the design had yet to bear out in terms of the branding and association aspect, what the model did do is to turn heads.

6.7 Prototyping the Interface

Another great benefit to having the full-scale model would be the ability to subsequently begin testing an interface design in its intended context.



Above is a shot of the potential user interface for the kiosk concept, which is mid-development. The design intent with the interface was first and foremost to present a straight-forward, easy to use system with



an effective streamlining of educational features for novice users as well as deeper, expanded features for drawing users into active participations in the bike-share system and the community at large. Shown opposite is what would be the one of the system's splash pages, all of which would cycle through while showing different representations of helpful, contextual information. In this screen the system would give a 'Snapshot' of a couple of interesting statistics as they relate to the viaCycle bikeshare community.

The photos show how, using paper prototypes of graphic user interfaces, it was possible to observe study participants as they had a go at signing up for a membership while following the prompts and other queues that were depicted in the screens. The evaluations followed the popular 'think-aloud' testing method for user experience design work.

Our participants 3 (opposite) and 4 (left) were the first to have a go at first registering for the service, then checking out a viaCycle on the paper prototype.

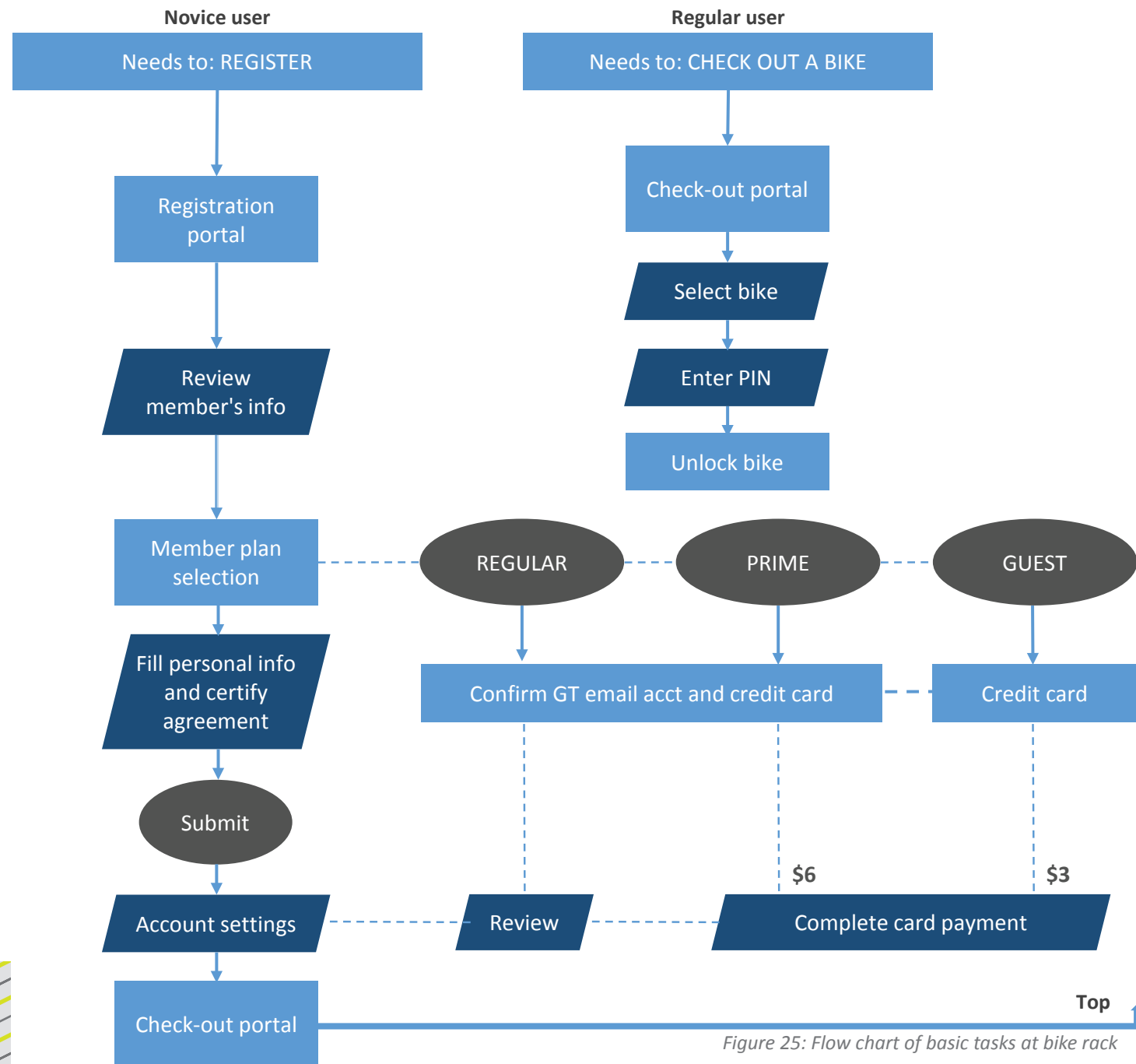


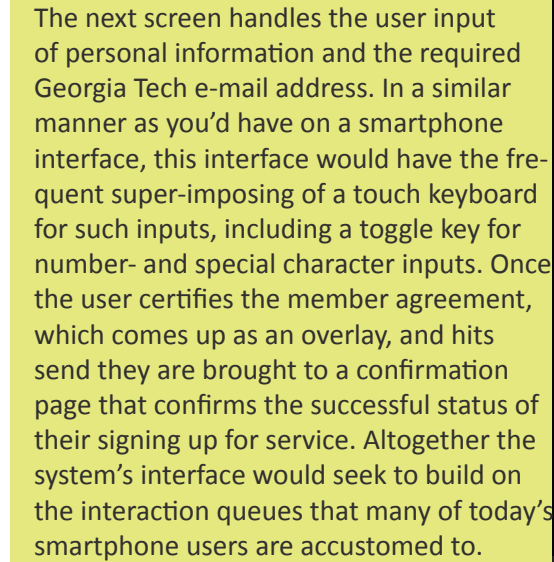
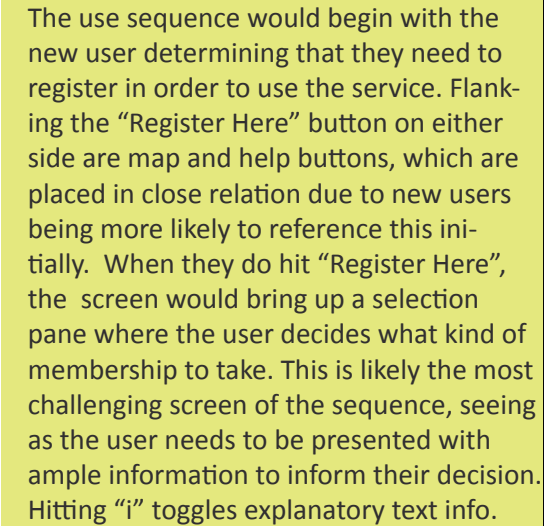
Figure 25: Flow chart of basic tasks at bike rack

In terms of the information architecture behind the interfaces, it was recognized that the system's novice users would be presented with prompts and information that is uniquely dense. Apart from needing to enter accurate information, their membership is also sensitive to the user's good understanding of information presented to them.

Selecting the right membership plan is a particularly crucial aspect of the sign-up process where graphic layout and organization play a large role in helping the user pick out the most pertinent information. Beyond that, the entering of your credit card information would be the final critical interfacial step before being able to eventually check-out a bike.

Something to acknowledge for such an information portal is the importance of feedbacks that confirm completion. An effective feedback loop keeps the user informed on the state of their progress is paramount for

avoiding confusion as well as excessive -- or even errant -- taps to the 'back' key, a place where too many of us have the shared misfortune of losing pages of personal information to an all-too-familiar 404 error page.

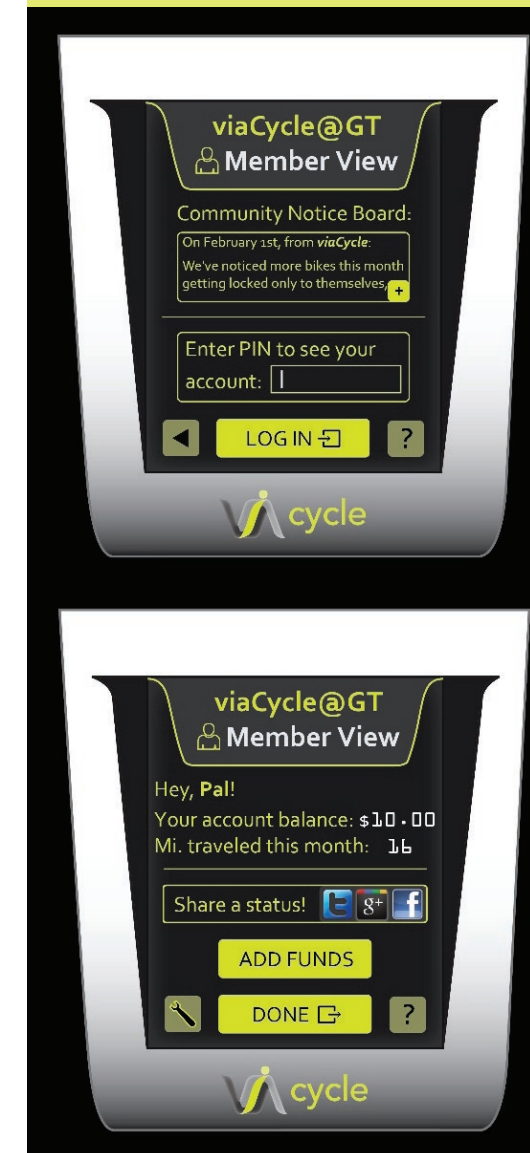
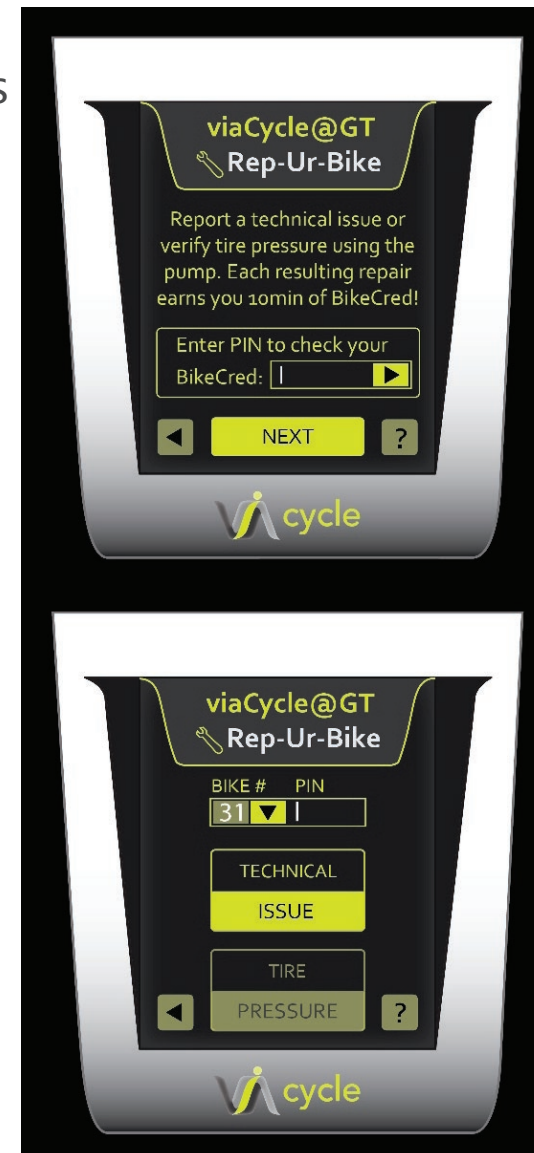


6.8 Inclusion and Incentives

A great way to uphold the community-building deliverable of the design goal is to incentivise bike-share users around the practices and activities that improve the quality of service while also helping to achieve that end. Potentially this could be managed within the software component of the system design.

One practice that supports an effective bike-share system is the reporting of bikes that need repair. Currently, viaCycle has a hotline that can be called to report issues with hardware, but the feedback loop doesn't appear to come back around to the originator of the report in a way that would incentivise them further. A software feature that might address this is Rep-Ur-Bike, which would credit the reporters of damaged or under-maintained bikes with free ride time. Helping to regulate tire pressure by using an available wifi-sensored pump is another prospect.

The interaction for this would be similar to the bike check-out interaction, where you select the desired bike from a drop-down list of bikes in the immediate vicinity (would be detected by the available GPS signatures).

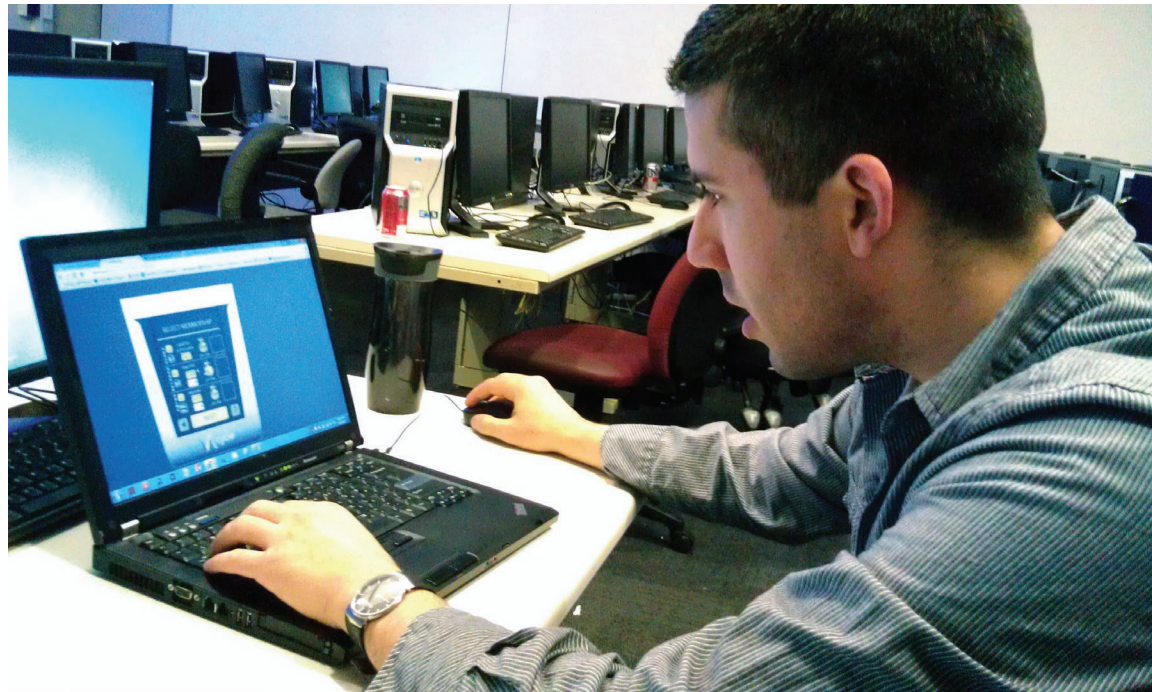


Apart from incorporating community-centric features, having an on-site account portal is a direct way to personalize the bike-share experience. While there's only so much that one might want a user to delve into directly at a shared kiosk, the software could streamline context-specific mechanics that enhance service participation. For one, it could incorporate a notice board for directing area-specific messages from viaCycle and other potential affiliates to the user right there on site.

"MemberView" could also be tethered to online social networks where a user might want to post automated statuses about their bike-share usage. For instance, upon hitting the "Share a status" social network of choice, the system could prompt the user to choose which of the available metrics they might like to share, including estimates of calories burned, average speeds, or miles traveled for a historical time range.

A logical companion to having these social features at a kiosk would be to have the same ones and more within the mobile app.

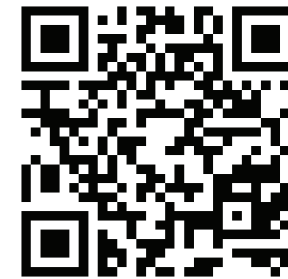
6.9 Interface Evaluations



Using Axure, a prototyping tool for interface designs, it was possible to produce a highly interactive prototype of the on-screen kiosk system for posting to the web via a link and receiving feedback through an integrated “Discuss” tab. Above, Participant 5 is able to pull up the prototype right within his everyday browser. While it became possible to achieve a much closer replication of the digital interactions for a final prototype, it lacked touch interaction and a physical context.

The interactive prototype can be found at the following URL, to which the scannable QR code links as well:

share.axure.com/3AGTZX/Home.html



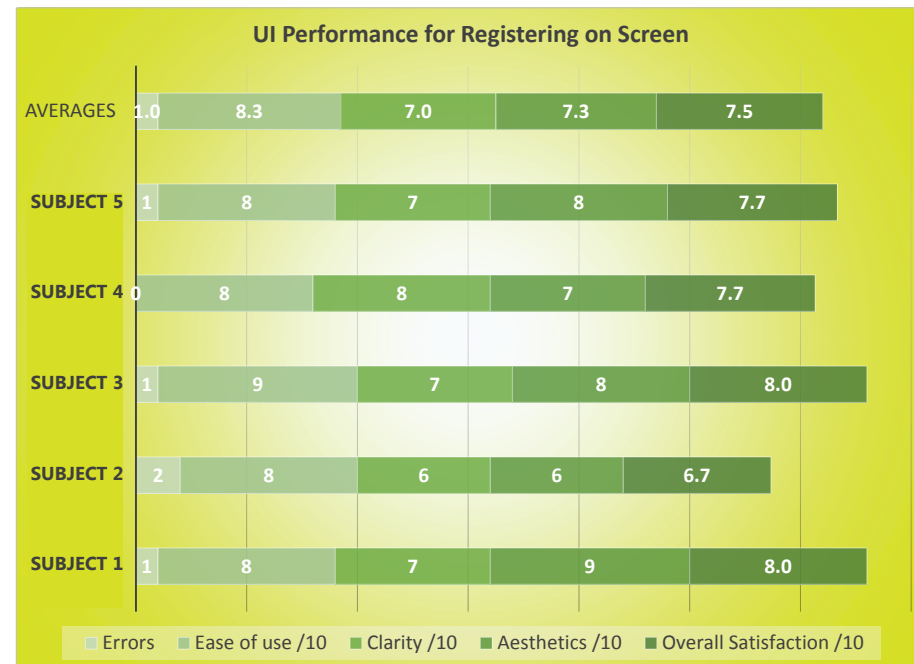
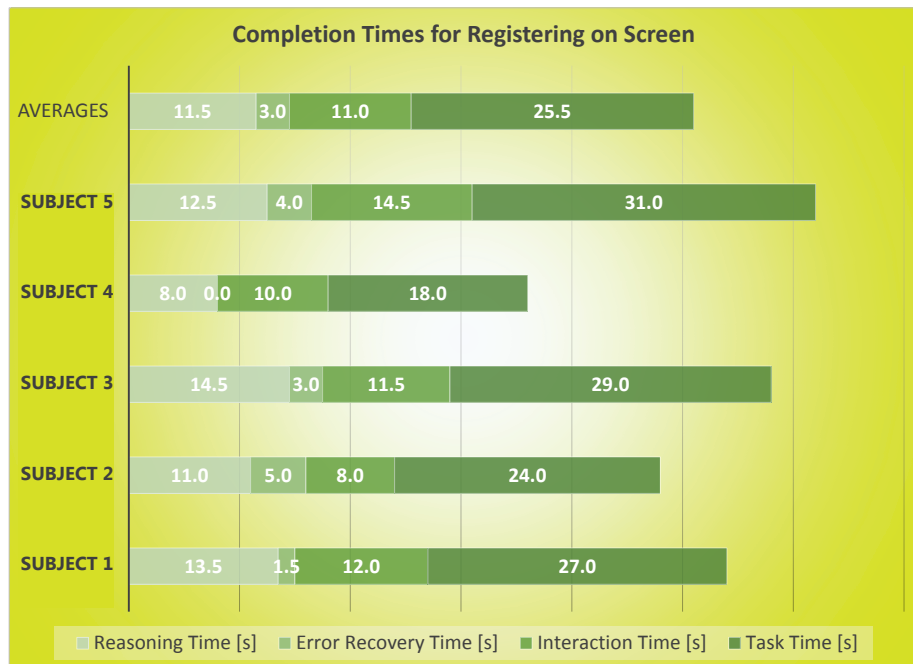
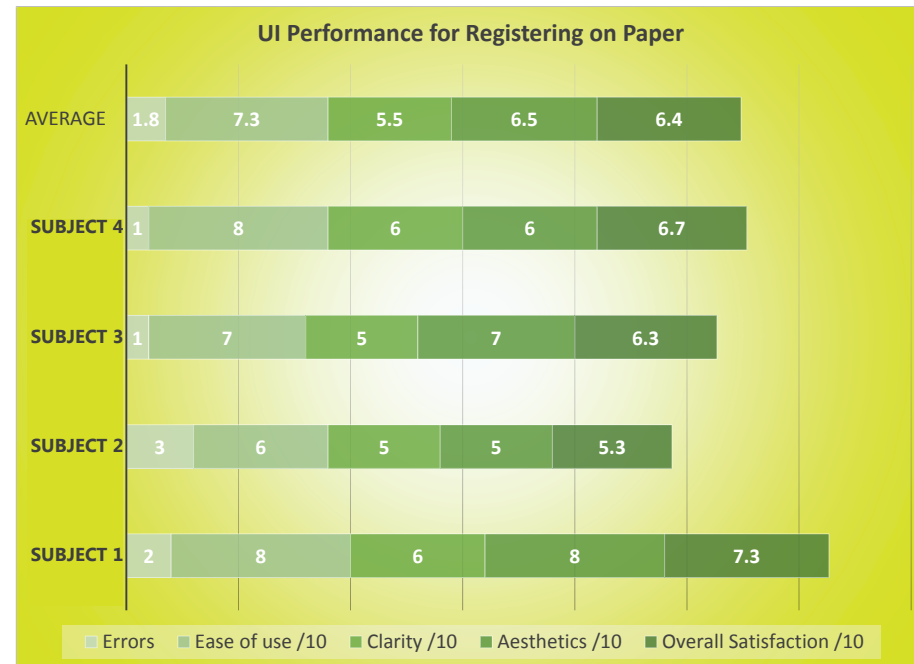
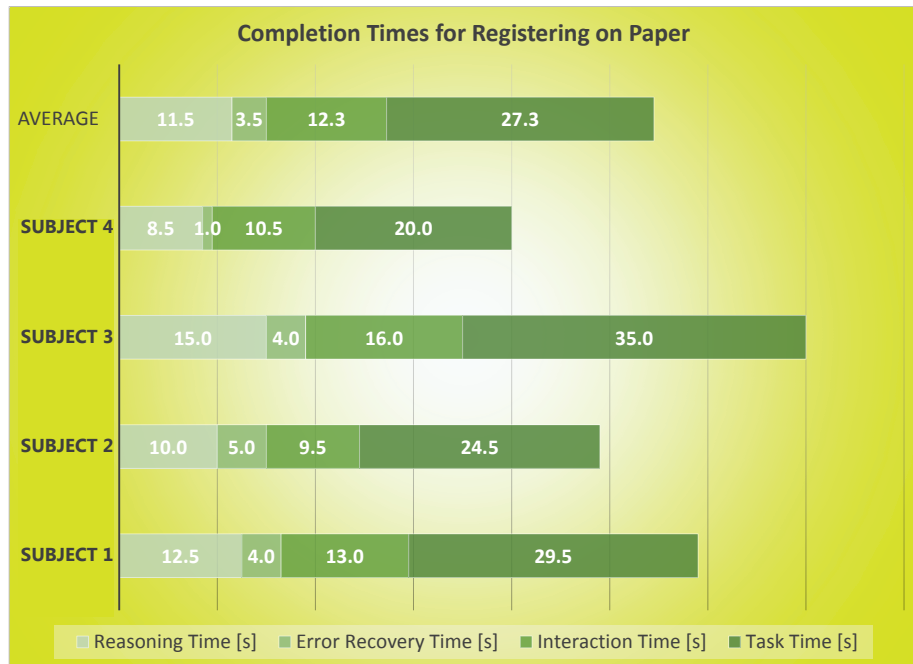
Evaluations coming out of the paper- and interactive prototypes indicate a high potential for the successful integration of the service support features. With respect to the providing an enhanced user experience

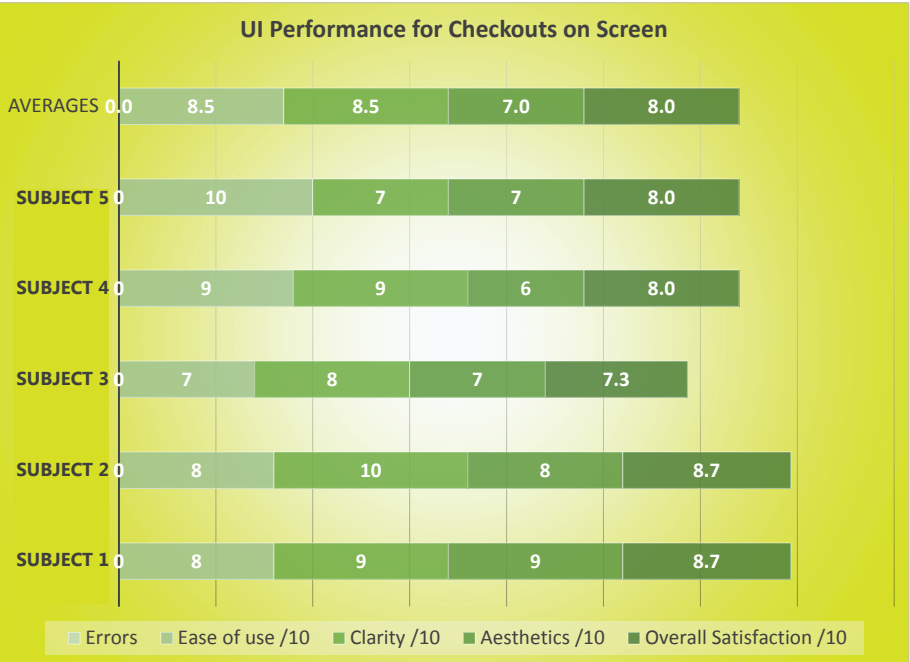
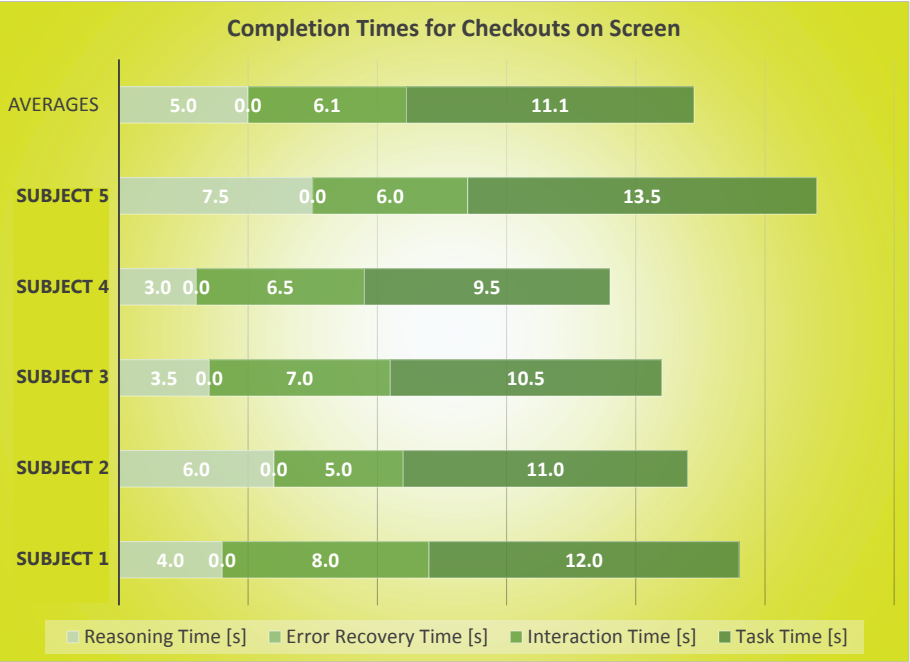
at the kiosk itself, there were several gripes about aesthetic elements, but the overall direction was taken to be rather successful. The following were found to be favorable:

- speed and efficiency: as compared to the bikeshare system Johann had tried in Washington, D.C. the process of signing up and checking out was breezy
- branding and contrast: the use of via-Cycle green made it visually distinct

Issues and shortcomings of the current iteration that would be addressed upon further development are:

- a lack of progress indicators at the registration phase, to reassure the user
- limited integration of possible member’s portal features
- the help button should offer more dynamic and context-specific queues





The evaluation results that involved previously recruited students, who all had varying levels of bike-share familiarity, show that affording an efficient, effective and satisfying registration process is likely the interface design's most critical objective to get right. While watching the recorded video of participants completing first a registration and then a bike checkout, it was possible to gauge how much time was spent in the reasoning (reading & comprehension), error recovery (going back until they advance again) and interaction (mouse movement, selections, and field entries) portions of each of the two tasks. A cursory look at the time differences makes it obvious that registration would account for a clear majority of the time spent with the system for first-time users, who are still forming their opinions on the service. So the interface design for registration is key, but for regular users the checkout screens will be more useful.

In terms of evaluating the designs, the feedback on important UI performance metrics shows that the on-screen, interactive prototype successfully improved on the user experience represented by the paper prototype, particularly for the registration process (Subject 5, who didn't see the paper prototype, isn't included in the averages). Meanwhile, the difference in checkout times were rather small but interestingly,

based on this user group sample, in a measure of task time per minimum number of clicks, the proportional time demand is actually slightly higher for checking out a bike (1.2 s/click versus 0.9 s/click for registering).

Finally, the participant were also asked for their opinions on whether the incentive portions of the interface designs addressed any of the project's four design rules:

- Participant 1:
- believes the touchscreen format does much to invite novice users
 - incentives inject a sense of shared ownership

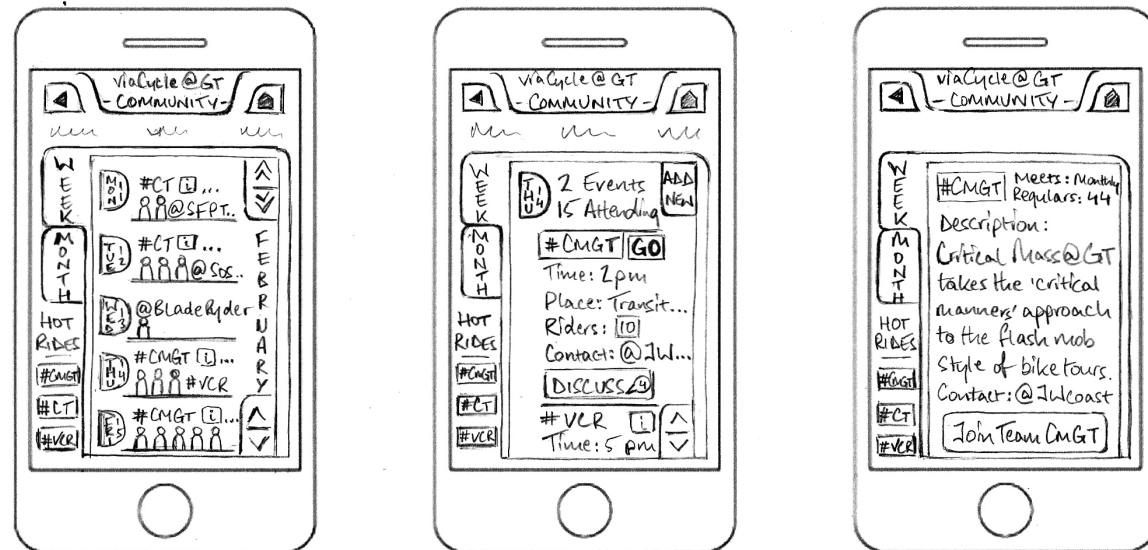
- Participant 2:
- thinks it would be fun to compare activity statuses with friends

- Participant 3:
- found the color scheme eye-drawing
 - can now imagine connecting with friends across campus more often than now

- Participant 4:
- really enjoyed the prospect of riding for free by helping to maintain bikes
 - likes utility of member messaging board

- Participant 5:
- feels like he has enough understanding of viaCycle service to share with others now

6.10 Application Design



Considering the limited regional engagement with bikesharing here in the southeast, it stands to show that there are very palpable ways for service users to contribute to broadening the awareness of the public around it. This in turn helps bike share systems such as viaCycle's be more viable or, at the least, more lucrative for implementing in less traditional markets.

The wireframes above show the conceptualization of a mobile app to help viaCycle's casual- and power users alike increase or otherwise manage their interactions with the local user-base and area cycling community at large. The envisioned interface would be organized like a shared calendar that incorporates the broad use of group- and event-tagging to allow the same to be easily searched and managed for user-determined activity feeds.

As a platform that would seek to facilitate community-directed campaigns much like as the once-notorious Critical Mass events of Chicago or San Francisco, it would earn a company like viaCycle considerable insight into the demands of its user base, such that it could helping it continually improve the service offerings of its platform.

It could also do great things for the progression of flexible bike-share systems when the so-called 'purists' of the cycling community begin to see its operators and vendors as being part of the same cause. Given that they can potentially be implemented more broadly, support at the grassroots level could stand to go rather far providers like viaCycle.

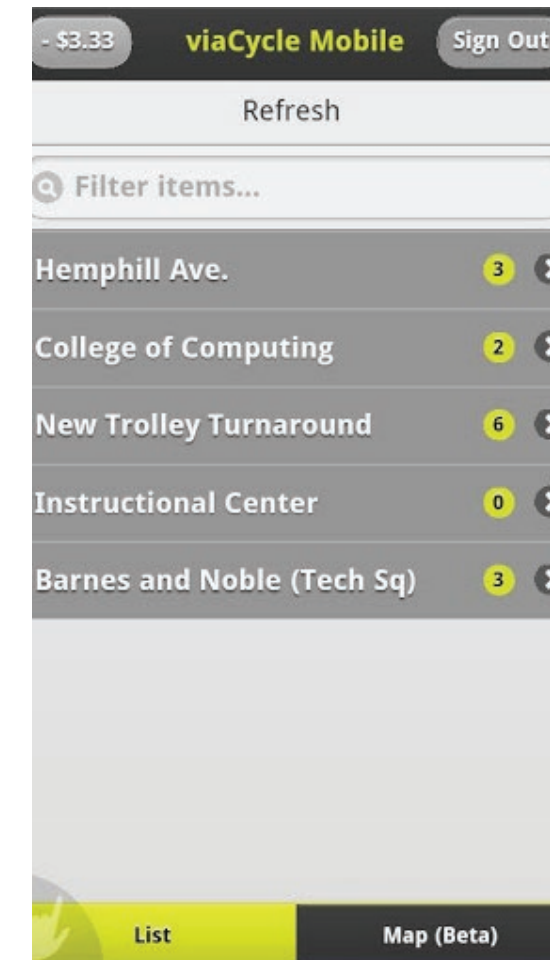
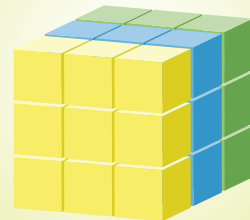


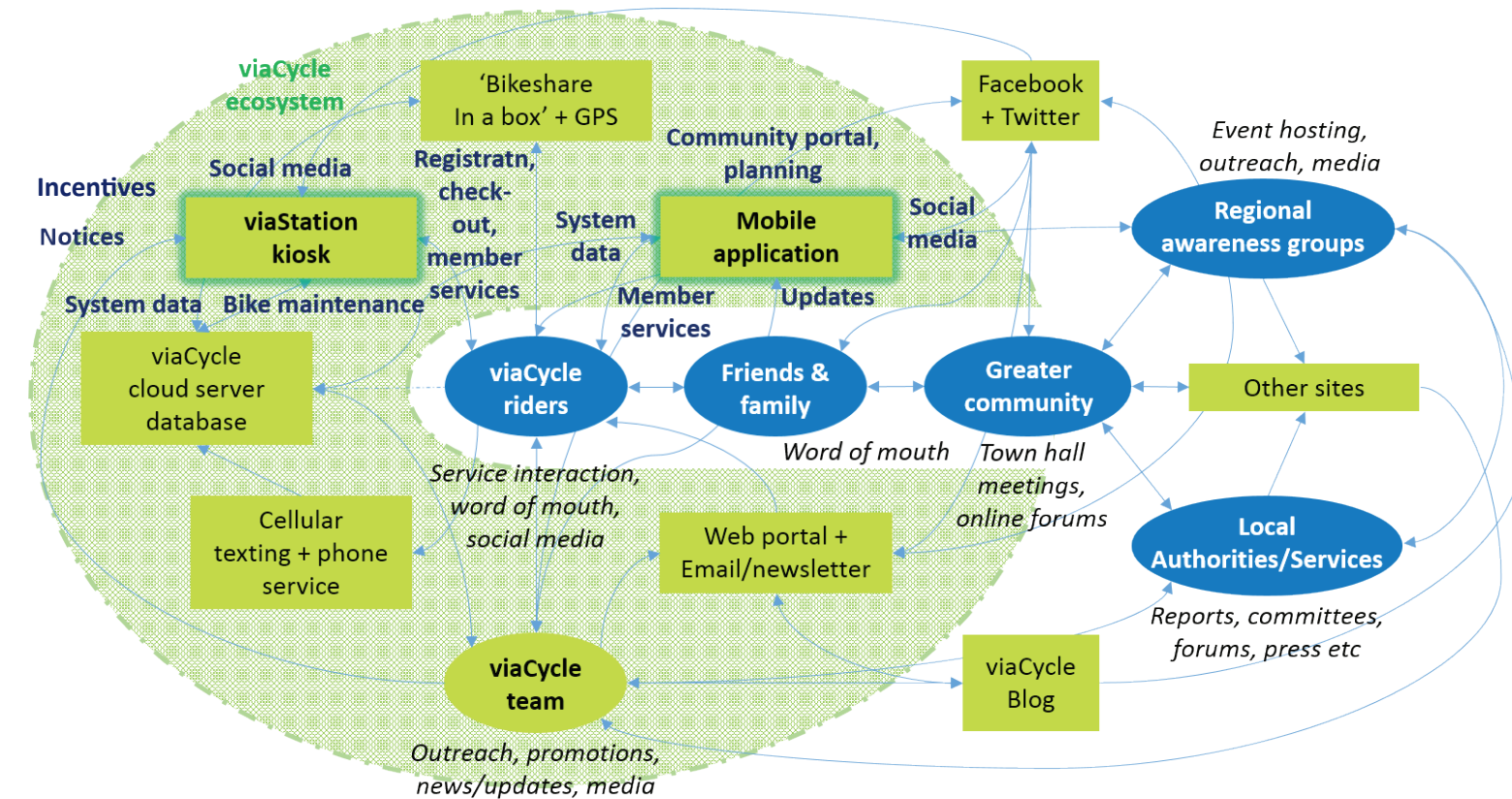
Figure 26: Screenshot of viaCycle's existing mobile app

85

- **Integration of complementary hardware and service design**
- **viaStation: the bike-share kiosk re-imagined for flexibility and community**
- **Metrics for implementation**



85



The envisioned system integration with the proposed hardware and interface enhancements are depicted above, showing a more user-centric service design approach. As a platform organization, it could enable a higher rate of interactivity with campus cyclists. This could in turn lead to more leverageable user activity data that could be used to target even more participation.

7.2 viaStation v1.0 - The Flag



***"The Flag"**
portal in context
at the Georgia
Tech Barnes &
Noble bookstore.*

Key Features:

- **Iconic**
- **Portable**
- **Self-powered**
- **Cloud-connected**
- **Versatile**



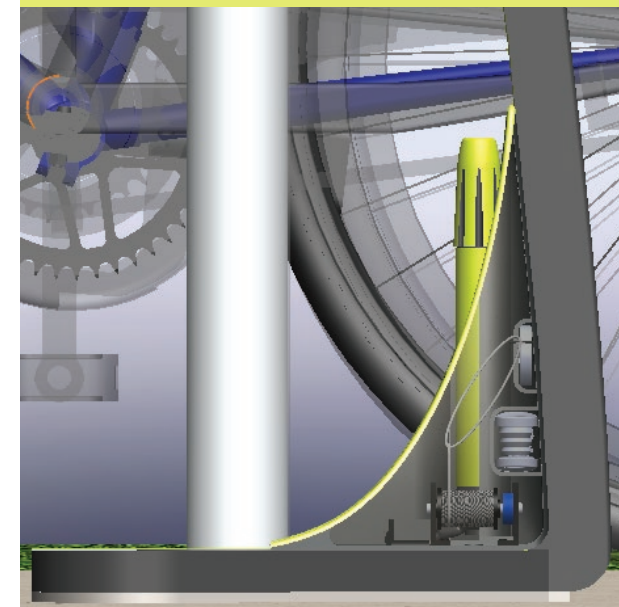
The Flag is a 6.5-foot flagship portal for placing at higher-traffic bike-share stations. It's independently powered by a 10" x 20" monocrystalline silicon panel that would, in clear weather, handily fulfil the expected 150 Watt-hour demand for an anticipated load of 50 customer transactions on a busy day at the Georgia Tech Barnes & Noble. Around the back, the Flag stands above the highest point of both 't-rex' and 'winder' racks for easy integration.

The back also features a lockable, water-tight display for area ads with products and services of interest to the local community. These places should be reachable by bike and could even run promotions where the rider receives store credits for showing up on a viaCycle. This way, bike-share and local businesses could create interesting co-ops that go beyond the sale of adspace.

At the front of The Flag, the user is greeted by a 12-inch LCD display with interactive software that is outfitted to guide them through several available tasks that range from service registration to checking their community notice board or even broadcasting a Twitter status to mark their latest achievements while bike-sharing. This would be possible by capturing data from the bike lock's GPS or other chips/sensors.

A look upward brings the user's attention to an ad or poster promoting news and events of particular interest to the cycling community at large. In this case, the Atlanta Bicycle Coalition would like to showcase the crowning cycling-related achievements for 2012; for instance, the city-wide installation of 26 new bike racks.

Yet another resource is a labeled backlit static map showing viaCycle locations along with basic LED indicators to signify how many bikes are available at any given station. This allows a quick read for regular users while keeping a service overview front and center for novice ones.



Seated at the base of the unit is an optional integrated toolkit to enable user-initiated fixes right there on site, in exchange for so-called 'Bike Cred', which is a free 10 minutes of riding. One would for instance use the manual air pump to check and correct a bike's tire pressure upon reporting it in the kiosk system's 'Rep-Ur-Bike' portal.

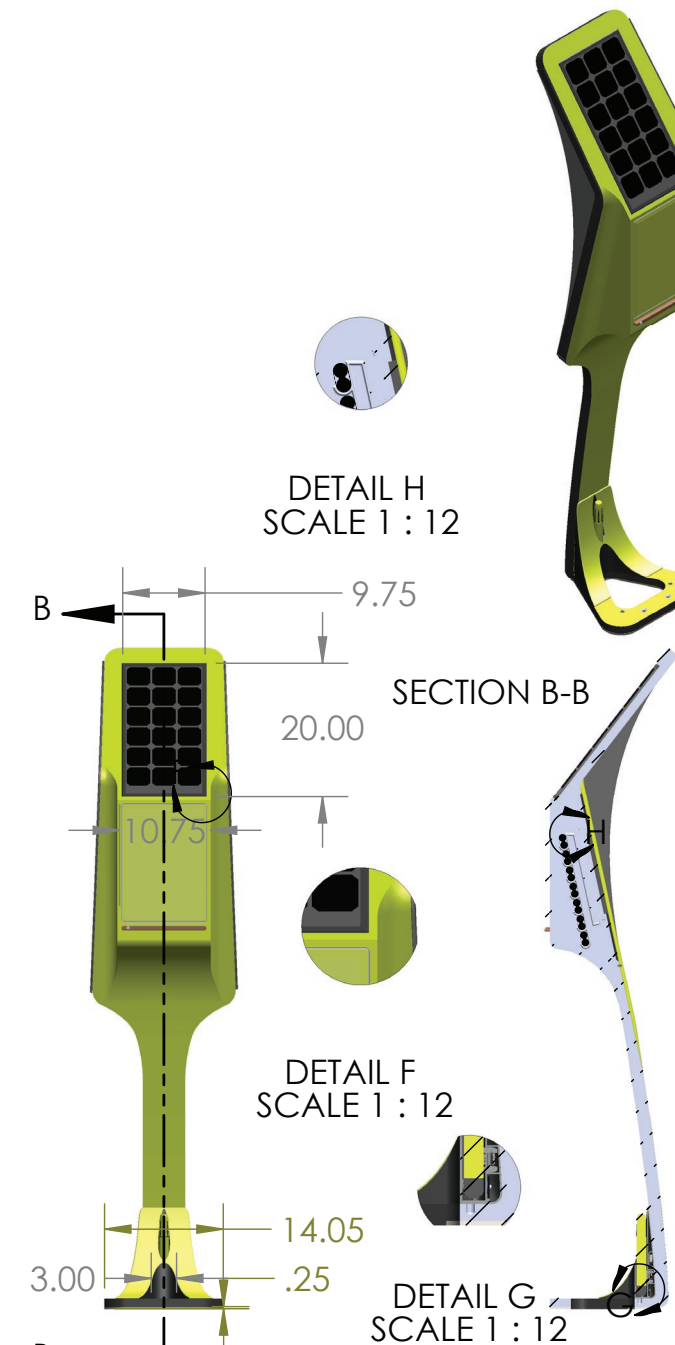
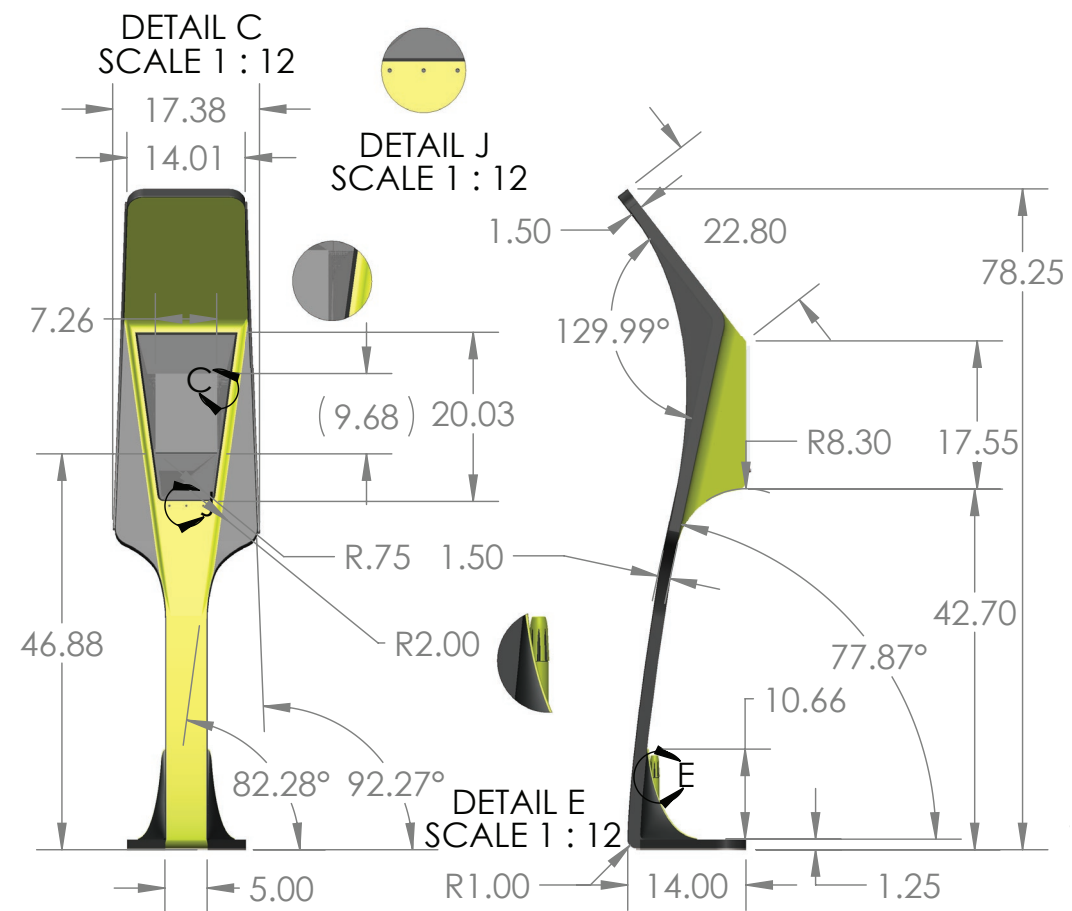
The housing of the pump, which opens on either side, would also serve as a secure storage compartment for additional tools for users to utilize in tending to viaCycle bikes for cycling credits that would



periodically be verified by technicians on the ground. The added tools are a headset- and an allen key wrench. To prevent theft, all three of the tools are fixed to the kiosk unit by way of durable, 6-foot cable wires attached by automatic spool.

Another important feature is the base plate's detachable back insert, which allows for the kiosk to be fixed around permanent street furniture like bike racks and other **suitable structures**.

7.3 The Flag's Dimensions



Standing at about 6.5 feet tall, the kiosks bears its weight at a center of gravity that sits directly above its trapezoidal foot and tool housing. The in-set touchscreen (flush with surrounding bezel) has a 12" diagonal.

The indicated detail features are as follow:

Detail C - speaker slots on either side of screen bezel

Detail E - integrated manual hand pump, secured in the biker's toolkit at the base of the structural stem

Detail F - monocrystalline solar cell

Detail G - interior of the toolkit

Detail H - solar power is stored by six to seven nickel-metal hydride battery units, each with a storage of 4.2A-hours @ 7.2V

Detail J - three IR sensors that activate the screen upon detecting movement

7.4 The Flag’s Product Specifications

Component	Type	Size	Load/Capacity	Units	Per day (~40 ppl, 4 hours)	Pricing Convention	Source
Screen	LCD with resistive touch	12" diagonal	30W	1	120Wh	\$90-150/unit	alibaba.com
Motherboard	viaCycle wireless controller	10"x6"	5W	1	20W	\$75-200/unit	Proprietary
Speakers	Surround/Satellite	2" driver	1W (RMS)	2	8Wh	\$1-5/unit	newegg.com
Batteries	Nickel-Metal Hydride	6"	7.2V @ 4,200mAh	6	180Wh	\$10-29.99/unit	robotshop.com
IR Sensors	3-5 meter optical sensor	10mm	2.7V @ 0.8mA	3	~.01	\$0.1 - 0.3/unit	alibaba.com
Solar panel	Monocrystalline silicon	530mmx280mm	17.2V @ 30W	1	180Wh	\$0.7-1.5/Watt (≥ 18% efficiency)	alibaba.com

Figure 27: Electrical component specifications

Component	Units	Cost per Kiosk	Cost per Kiosk / 5	Cost per Kiosk / 10	Cost per Kiosk / 15	Cost per Kiosk / 20	Cost per Kiosk / 25
Screen	1	\$150	\$140	\$130	\$120	\$110	\$100
Motherboard	1	\$200	\$200	\$175	\$150	\$125	\$100
Speakers	2	\$10.00	\$9.00	\$8.00	\$7.00	\$6.00	\$5.00
Batteries	6	\$180.00	\$180.00	\$150.00	\$120.00	\$90.00	\$60.00
IR Sensors	3	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
Solar panel	1	\$60	\$60	\$54	\$48	\$42	\$36
Sub Total		\$601	\$590	\$518	\$446	\$374	\$302

Figure 28: Electrical component costs

The above tables show a breakdown of specifications for the design’s core electrical components. A central challenge to having the station be off the grid and self-sustaining was in ensuring a sufficient power supply over the full course of the day, seeing as viaCycles are in service for a full 24 hours. Monocrystalline solar panels were selected to be dependable for at least 6 hours of energy capture per day, where the relatively high efficiency rating of the substrate type would allow it to deliver 180Wh daily.

7.5 Production Costs

	Part	Size	Raw Material	Material Cost [\$ /lb]	Process	Units-per-kiosk	Density [lb/cu.ft]	Production/Finishing Cost [\$ /unit]
1	Internal brackets	10"x6"x.25"	steel	\$0.35	extrusion	4	484	\$1.00
2	Face plate (1)	82"x14.5"x.125"	aluminum	\$0.85	metal stamping	1	167	\$10.00
3	Face plate (2)	36"x17.5"x.125"	aluminum	\$0.85	metal stamping	1	167	\$10.00
4	Rear top	15"x22"x.125"	aluminum	\$0.85	cold stamping	1	167	\$10.00
5	Rear case	22.5"x16"x.125"	PPO (polyphenylene)	\$1.36	injection molding	1	67	\$12.50
6	Rear plate	8"x40"x.125"	aluminum	\$0.85	cold stamping	1	167	\$10.00
7	Top casing	12"x10"x6" (half)	PPO (polyphenylene)	\$1.36	injection molding	2	67	\$12.50
8	Screen bezel	13"x20"x.5"	glass	\$1.00	cut & sand	1	160	\$10.00
9	Side visors	40"x4"x.25"	acrylic sheet	\$1.00	milling	2	74	\$1.00
10	Display screen	14.5"x10"x.5"	acrylic panel	\$1.00	milling	1	74	\$1.00
11	Display Base	14.5"x1"x.5"	birch wood	\$1.25	saw cut	1	42	\$1.00
12	Base Plate	14"x14"x.5"	steel	\$0.35	milling	1	484	\$2.00
13	Hand pump	10.5" (major)	plastic, metallic bore	---	---	1	---	---
14	Allen wrench key	4" (major)	steel, plastic casing	---	---	1	---	---
15	Headset wrench	6"	steel	---	---	1	---	---
16	Spools & cable wire	various	mixed	---	---	3	---	---
17	Screws/ fittings	various	mixed	---	---	50	---	---

Figure 29: Electrical component specifications

The major part of The Flag’s housing is assigned to be formed of metal-stamped sheet aluminum and two injection-molded parts of a polyphenylene (PPO) plastic. Aluminum would allow the amiable combination of imparting the requisite structure as well as weight savings for maintaining the station’s portability. PPO, meanwhile, is noted not only for its impact resistance but also for the weather resistance for holding up to the elements that The Flag would need to endure for over 9 months out of the year.

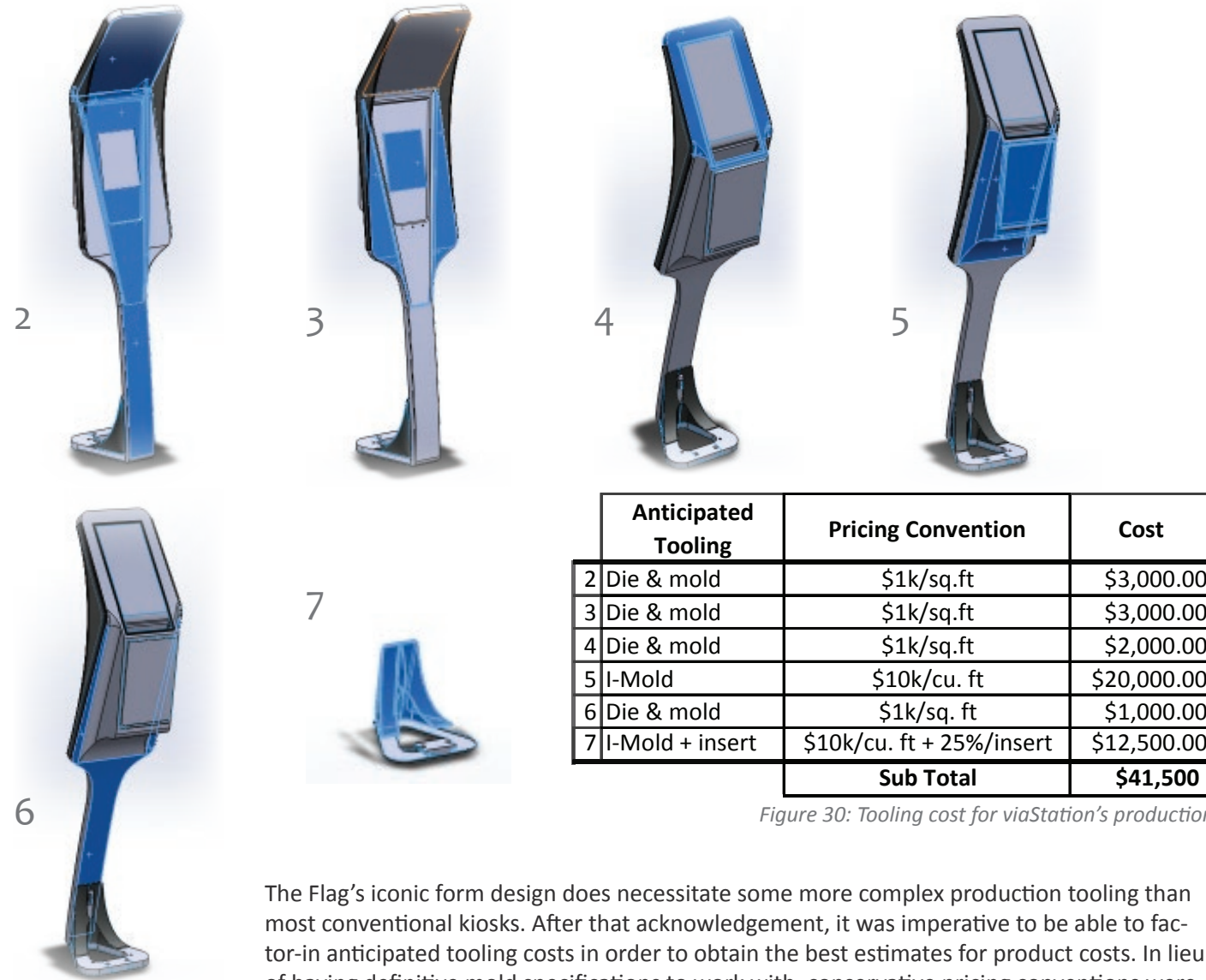


Figure 30: Tooling cost for viaStation's production

The Flag's iconic form design does necessitate some more complex production tooling than most conventional kiosks. After that acknowledgement, it was imperative to be able to factor-in anticipated tooling costs in order to obtain the best estimates for product costs. In lieu of having definitive mold specifications to work with, conservative pricing conventions were applied to obtain a tooling cost for each major mold part, each based on a cost per unit area.

	Part	Fixed Cost-per-Kiosk [\$]	5-unit Variable Cost-per-Kiosk [\$]	10-unit Variable Cost-per-Kiosk [\$]	15-unit Variable Cost-per-Kiosk [\$]	20-unit Variable Cost-per-Kiosk [\$]	25-unit Variable Cost-per-Kiosk [\$]
1	Internal brackets	\$9.88	---	\$0.00	\$1.00		
2	Face plate (1)	\$11.23	\$600.00	\$300.00	\$200.00	\$150.00	\$120.00
3	Face plate (2)	\$11.23	\$600.00	\$300.00	\$200.00	\$150.00	\$120.00
4	Rear top	\$11.23	\$400.00	\$200.00	\$133.33	\$100.00	\$80.00
5	Rear case	\$13.29	\$4,000.00	\$2,000.00	\$1,333.33	\$1,000.00	\$800.00
6	Rear plate	\$11.23	\$200.00	\$100.00	\$66.67	\$50.00	\$40.00
7	Tool casing	\$26.58	\$2,500.00	\$1,250.00	\$833.33	\$625.00	\$500.00
8	Screen bezel	\$11.39	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
9	Side visors	\$3.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
10	Display screen	\$1.64	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
11	Display Base	\$1.46	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
12	Base Plate	\$3.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
13	Hand pump	\$20.00	---	---	---	---	---
14	Allen wrench key	\$10.00	---	---	---	---	---
15	Headset wrench	\$5.00	---	---	---	---	---
16	Spools & cable wire	\$15.00	---	---	---	---	---
17	Screws/ fittings	\$12.50	---	---	---	---	---
	Electrical components	---	\$590.00	\$518.00	\$446.00	\$374.00	\$302.00
	Assembly & testing	---	\$500.00	\$400.00	\$300.00	\$200.00	\$100.00
	Coat, cure and detailing	---	\$500.00	\$400.00	\$300.00	\$200.00	\$100.00
	Sub Total	\$178.43	\$9,890.00	\$5,468.00	\$3,813.67	\$2,849.00	\$2,162.00
	Total Cost per Station WITHOUT toolkit		\$7,491.84	\$4,319.84	\$3,082.18	\$2,325.84	\$1,763.84
	Total Cost per Station WITH toolkit		\$10,068.43	\$5,646.43	\$3,992.09	\$3,027.43	\$2,340.43

Figure 31: Major part costs



Left, a final render of the flag in the context of the common t-rex rack and a generic cruiser city bike. Meanwhile the render below shows The Flag's mobility in being portable by van or truck, which would be desirable for responding to jumps in demand on particular days when major events are taking place nearby -- as happened with this year's Final Four games. At roughly 150 lb, moving it would require two or three people.



7.6 Evaluation Against Design Rules



Rule #1: Attract novices

At the time of choosing between the conceptual directions for the hardware design the opinions of several peers, who themselves are bike-share novices was sought to get a sense for what forms would be most attractive. While it won out a bit more narrowly with the stakeholder group, after viewing the same concept sheets as the ones shown in Section 6.3, 'The Icon' concept theme won handily over the other two directions with the peers. Left, a maker-bot scaled model of the final Flag design has also gone over well in advance of a near-complete full-scale model (opposite) that will allow for in-context feedback and user observations.

Additionally, in a concurrent comparison between a rendering of The Flag and the image of a CitiBike station (see p99) the following, out of five opinions, were the three most popular adjectives (out of three) that were used to describe each:

viaStation - 'eye-catching'(4), 'cool'(2) or

'fancy'(2), and 'bright'(2)

CitiBike, NY - 'advanced'(3), 'robust'(2), 'regular'(1) or 'familiar'(1)

Going by how the two were described, the viaStation Flag would seem to have elicited the more interest-peak reaction, but a more rigorous comparison is needed. Of note: it had to be specifically explained prior to feedback that The Flag would be a system dedicated to bikeshare.

Rule #2: Changing the psyche

During the course of the design development for the user interface, the interactive prototype was able to draw a great deal of feedback that, taken against the results of the general survey, were showing strong signs of being able to shift the community mindset. After following up with three participants who evaluated the user interface and self-described as being completely new to bike-share, two said they have since signed up for the service. Jason in particular, who graduated last year but is thankful to still be able to use his GT email address, had told his friend about it so that they could meet for lunch sometimes. At the time of this report, however, there was no word yet on whether his friend joined too.

Rule #3: Lowering Barriers

The technical aspects to lowering the barriers to access have been covered in terms of cost and infrastructure. Additionally, the user interface as compared to the current phone-based interactions for viaCycle's service has been judged favorably, but a decisive difference will be best judged when the experienced alongside the full-scale prototype.

On the right is a shot of the front face of the prototype which, at the time of this document, is still in the making. An iPad will be fixed into the front cavity to be able to simulate the touchscreen interface during evaluations of the viaStation





prototype in context while the evaluation method would be based in the observation and interviewing of passers-by who observe, inspect, or hopefully stop to interact with the prototype. An important aspect of this evaluation would be that they are carried out at either of the two viaCycle racks that have the highest portion of foot traffic by novice users or campus visitors (Barnes & Noble or CULC). Left, the prototype is fully-assembled but lacking a paint job and finish to help it read as a viaCycle service station.

Rule #4: Liberating the user

Anecdotally, there were two study participants who noted that their initial signups for using the viaCycle service had ended in confusions over whether their memberships were active or not, due to an unforeseen requirement to pay for the service upfront. Not knowing whether it would work, this prevented them from ever planning to use the service. After using the interactive prototype for on-site registration, participant X noted how the interface would be great for easily allowing them to return at any time to add funds and periodically view their balance. In this way, the interface improves on the online route to account management.

7.7 Evaluation Against Major Design Criteria

Marketability

The aforementioned feedback from the side-by-side comparison (below) brought out a number of impressions concerning the visual design that would speak to the improved marketability of viaCycle's service due to being highly recognizable and attention-grabbing. However, aspects of the



viaStation's functional design such as the social media integration or the very visible implementation of solar energy would show improved marketability over existing kiosk solutions like the one for CitiBike. Additionally, the cycling advocates among the participants noted the Flag's low infrastructure and cultural queues as being appealing.



Sustainability

Not having the benefit of a functional production model to observe through its lifecycle, the definitive sustainability of The Flag is difficult to evaluate as a mere concept. That said, the theoretical ability to use existing technology to function on solar energy alone, without putting any load on the electrical grid whatsoever, goes a long way in fulfilling this directive. Using aluminum throughout the panelling of The Flag is another positive aspect for sustainability in that it is an especially reclaimable material.

Appeal & Aesthetics

The appeal of The Flag concept to students who are new to bike-share, especially those who commute to campus by car daily, would also be difficult to assess completely without the full-scale prototype for observations in context. From presenting the sketch concepts, however, the 'Icon' theme did garner the most enthusiasm about a potential kiosk product to be implemented around campus. Also in terms of aesthetics, the Icon was appreciated for its thin profile, tall stature, and easily viewable screens.

Ergonomics:

The screen's height of about four-and-a-half feet off the ground (to the center), puts it at an ergonomically suitable level according to guidelines from the FAA. The touch controls

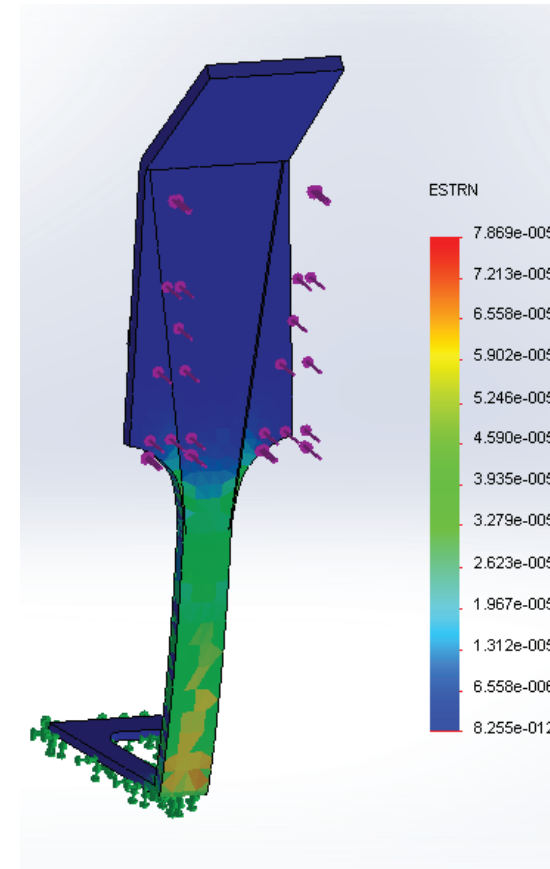
would be very accessible by all folks well around the 5th percentile of ladies (approx. 55in) as well as the 95th percentile of men (approx 73in). Also, the display's 22.13° tilt that is imparted by the stem's curvature does seem to help them maintain an ideal viewing angle of 45° for each user in the aforementioned 5th-95th percentile. Additionally, maintaining the touch controls at this height enables a quick and easy reach for all that appear on the screen.

Function

While a full evaluation of the function of the viaStation would require much testing of a functional full-scale prototype, much could be assessed using the interactive prototype in terms of seeing the extent of possible functions. The combination of hardware and components, meanwhile, would seem to afford the major necessary interactions as well as more trivial/sensory ones.

Physical

The robustness of the flag's physical build would be apparent in the ability to achieve a stable center of gravity, having the optional fixture to street furniture, and utilizing aluminum framing throughout the structure. This makes it more susceptible to break in than by using another material option, but the weight savings without giving up too much in strength make it a worthy trade-off.



Above, a strain plot depicts the relative stresses throughout the Flag if and when the front face would be leaned on or faces a head wind with 200N of applied force. The base of the stem clearly bears the brunt of it at the joint of its crucial, tip-preventing foot.

Cost

It proved difficult to keep the costs low at this concept stage of The Flag. With a conservative estimative of costs at under \$6000 after ten units, however, a case begins to be made that viaStation would readily return value on the initial investments in a way that contemporary 'kiosked' bike share moments couldn't do for much longer periods after implementation. As a point to compare against, Washington DC's Capital Bikeshare costs up to \$52000 when it's all said and done including items like the \$3000 installation cost -- for every single kiosk! The flag concept, meanwhile, would limit an operator's infrastructural expenditures dramatically.

Manufacture

For the envisioned manufacturing process the assumption is that a scaled, mass production run, with the corresponding tooling needs, would be utilized. This in addition to the pricing conventions concerning the injection molds and 3D stamping, in particular, make the projected production cost especially conservative, i.e. higher than would be expected with more optimal production scaling. Considering this, and the possibility of an eventual high-volume production run, the outlined process would seem to be well considered for optimizing future production and enabling more relevant cost projections.

7.8 Implementation



Figure 32: Total cost per station for different implementation levels versus the targeted production cost

As a flagship station that operationally is supplemental to being able to use the bike-share platform, The Flag would initially not be implemented in the large numbers that one would see for big-market bike-shares that administer the service primarily through their kiosks. Instead, for a flexible platform such as viaCycle's, the desirable approach to implementing The Flag would be to target the hotspots for foot- and bike-traffic among the service areas so as to maximize bang-for-buck by having open access to a novice-friendly interface that streamlines participation.

Opposite, the chart shows how the cost per station would be eased down considerably with every increased level of implementation. Also, since the cost of the toolkit's present design may be prohibitively high for including as a standard configuration (less favorable cost-benefit comparison), The Flag's cost has been evaluated for both a configuration with- and one without the toolkit included. Meanwhile, the target cost for a viaStation that was assessed as the equivalent sum of two viaCycle bikes

(hardware analogy) and one CRM software license (software analogy) is also represented at right about the \$6000 level. Based on the talks with Kyle, it would be safe to say that this price tag represents the upper limit of viaCycle's desired investment per unit production of a proposed viaStation system.

The chart let's us know that to arrive at this price point, viaCycle would look to implement at least seven tool-less Flag stations or at least ten stations with the kit included per production run. Given their almost 40-bike platform at a sprawling campus like Georgia Tech's, it seems there could be enough activity to warrant implementing more than one such station per given service area. While they may sooner test the integration at a more consumer-facing operation, for instance at their pilot program in Las Vegas, the realization of increased community participation and new-user adoption would make The Flag a strategic asset at any of their service locations. If true, it could be assessed that the biggest barrier to implementing modern bike-share -- cost -- has indeed been addressed.

- **Be more visible**
- **Higher investment in the mobile app-space**
- **Incorporation of incentive programs, local partnerships**
- **More tie-ins and events supporting cycling culture**

8. RECOMMENDATIONS



8.1 Leveraging Mobile Apps, Increasing Presence

To summarize the key takeaways that came from this study and design developments therewith, it can be said that there are many yet-to-be-realized gains from continuing to invest in flexible bike-share innovations. For starters, not shying away from bigger roles in the area transit network can bring about a better conscience about maintaining healthier, un-polluted lifestyles in the communities where they operate.

In order to trigger said conscience, however, they must first increase their presence. This is where, with the lack of private infrastructure, platforms like viaCycle's can and should get creative about when, where or how they can leverage networked media. If not clearly visible on the street, they should at the very least be trackable online.

Along the same lines, there would seem to be a striking potential for bike-shares to incorporate a number of diverse mobile applications that could share data with their systems toward helping them deliver more multifaceted and fun transit experiences than at present.

8.2 Contributions to Cycling Culture

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Just like any other bike-share, flexible systems like viaCycle's face the common redistribution and maintenance hurdles that can only be so well addressed by operators alone. Flexible bikeshare would, almost by definition, have the most imperative to popularize incentives that help to bring about the requisite systemic order.

What the viaStation proposal does in these aspects is to embody the concept of shared ownership among a networked and technology-empowered community. In this way, the bike-share takes on the meaning that is most dear to heart to those that use it the most, while by no means losing its function. This is thanks to the reinforcement of physical access portals that continues to actively recruit participants for the use and, even, proliferation of the service.

It is fair to assess that the local viaCycle operation, with the founders also representing the GT community, is in a particularly strong position to write the rule book on making bike-shares adaptable to the transit or recreation leanings of any community, be it to support Critical Mass or Bicycle Highways.

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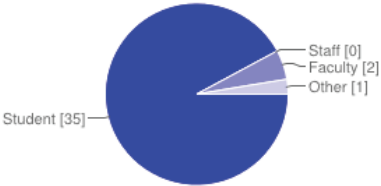
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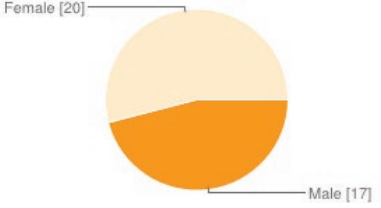


What's your primary role at Georgia Tech?



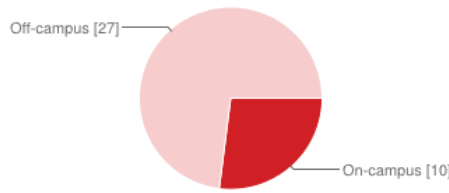
Student	35	92%
Staff	0	0%
Faculty	2	5%
Other	1	3%

What's your gender?



Male	17	45%
Female	20	53%

Do you live on- or off-campus?



On-campus	10	26%
Off-campus	27	71%

If you live on-campus, what residence building?

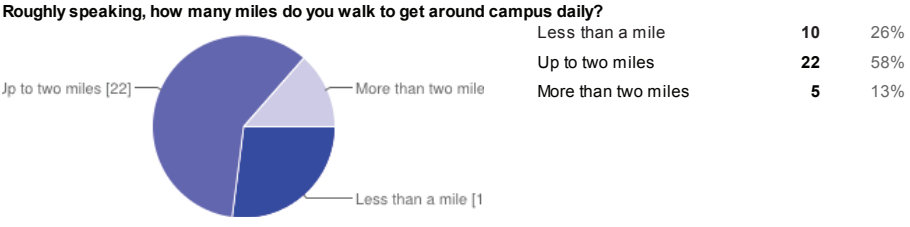
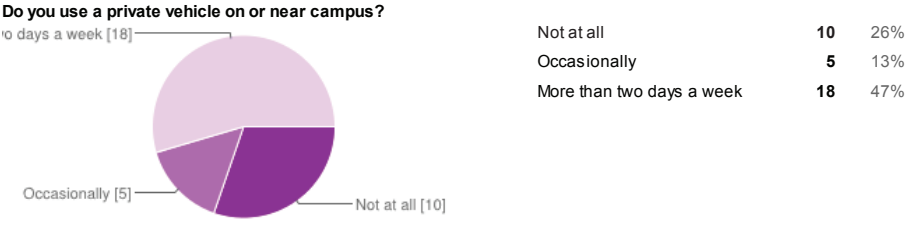
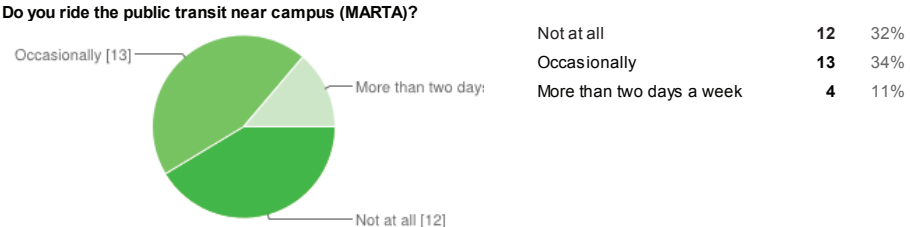
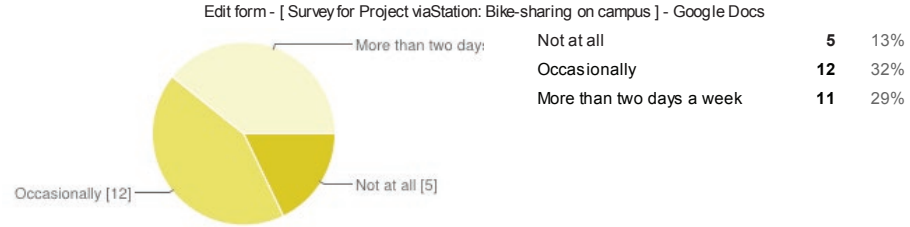
Tenth and Home Avenue	4th street apartments	Tenth and Home Graduate Living Center	Greek Housing North Ave Apts	North Ave South Crecine	Tenth and Home Center Street	North
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Do you ride the campus trolley or shuttle services?

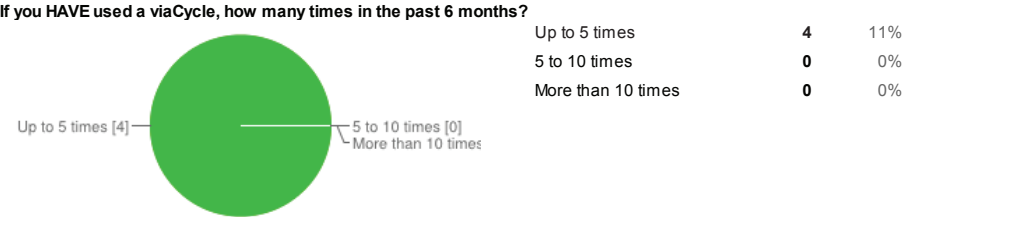
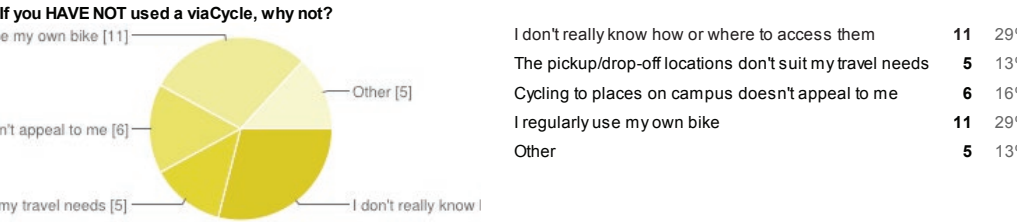
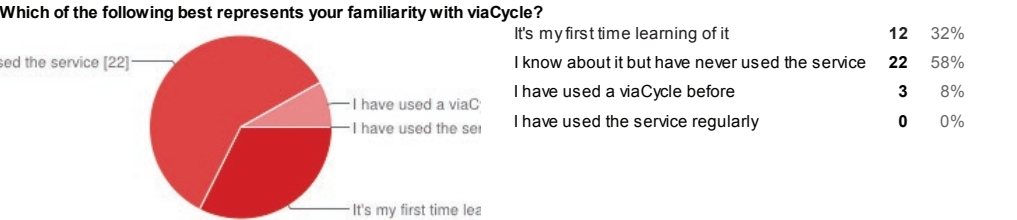
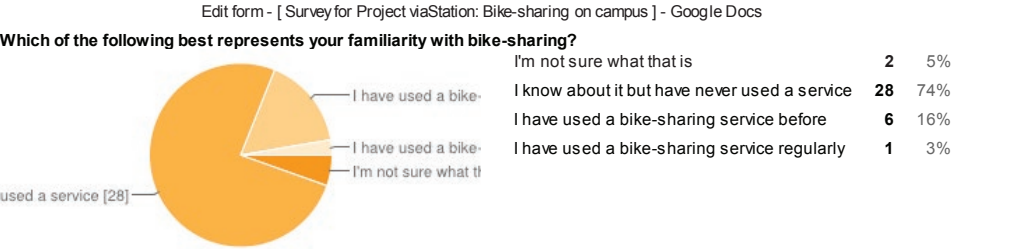




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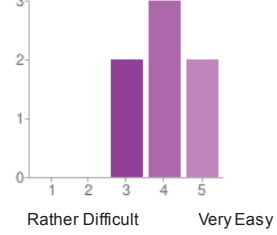


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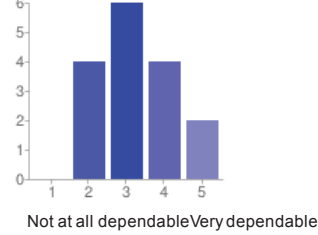


If you HAVE used the service, how would you rate the general ease of use?



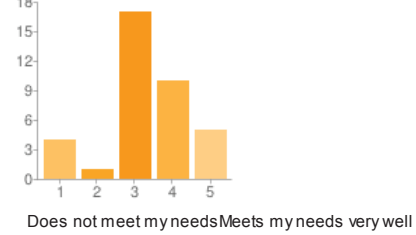
1 - Rather Difficult	0	0%
2	0	0%
3	2	5%
4	3	8%
5 - Very Easy	2	5%

If FAMILIAR with the service, how would you rate the availability of bikes near locations of interest to you?



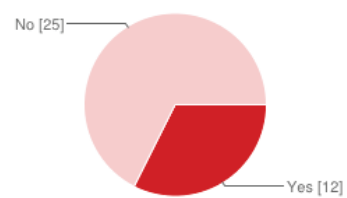
1 - Not at all dependable	0	0%
2	4	11%
3	6	16%
4	4	11%
5 - Very dependable	2	5%

How would you rate the general ease of use of modern (touchscreen) kiosks?



1 - Does not meet my needs	4	11%
2	1	3%
3	17	45%
4	10	26%
5 - Meets my needs very well	5	13%

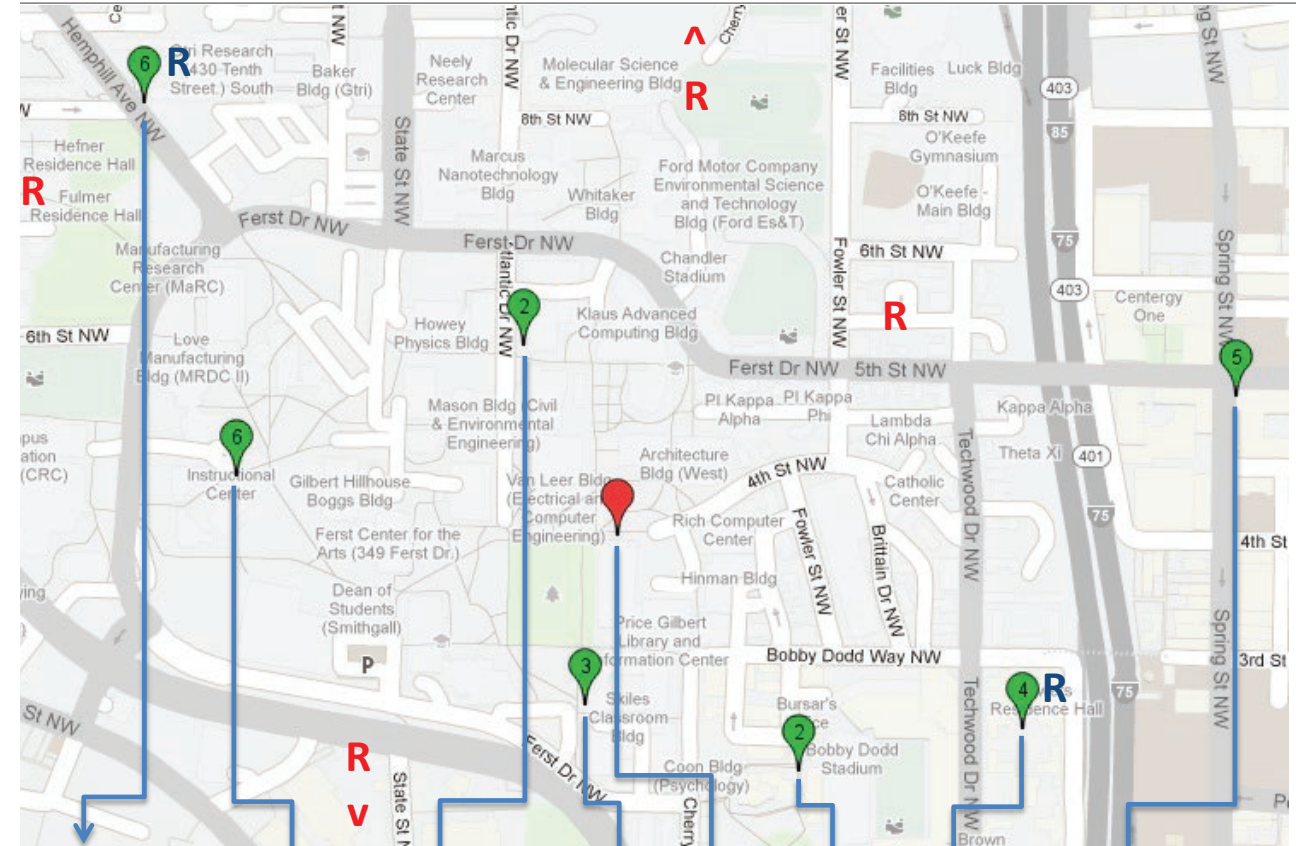
Are you a member of the Cycling Club, SfPT or SOS student organizations at Georgia Tech?



Yes	12	32%
No	25	66%

Any additional comments on your general bike-sharing experience:

I found it difficult to answer the question about why I haven't used viaCycle before because none of the answers suited my situation. I fully support the program and think it is wonderful. However, I haven't used it because I have my own bike that I ride to campus every day. Perhaps this option should be one of your answer choices. Also, the survey form made me answer the questions about my experience with viaCycle even though I haven't used it... The one time I tried to use viacycle I couldn't get the bike to unlock with my phone. Ignore my answers to "Have used service"... your system fo ...



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- Computing
- Transit Cent
- CULC
- Tech Tower
- Techwood Dr
- Barnes & Noble



